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MSS. intended for publication and books, etc., intended for review should be sent to the responsible editor, Professor J. McKeen Cattell, Garrison-on-Hudson, N. Y.

UNIVERSITY REGISTRATION STATISTICS.

A COMPARISON of the figures on the table with those for 1902 (SCIENCE, N. S., Vol. XVI., No. 417, December 26, 1902, p. 1022) will show that at the majority of the institutions given in the table the number of students enrolled during the present academic year represents an increase over the registration of last year. Several institutions have suffered a slight decrease in attendance and the general gain is not as marked as it was last year, yet on the whole the figures point to a normal and healthy growth, and the steady forward movement in the progress of higher education has continued virtually unchecked. Undoubtedly the present economic conditions of the country are partially accountable for this slight falling off in the percentage of general increase, but the effect, if any, can scarcely be regarded as serious, and would, in the ordinary course of events, not be felt keenly until next year.

The statistics given on page 738 are, with few exceptions, approximately as of November 1, 1903, and relate to the registration at twenty of the leading universities throughout the country. In order to avoid all misapprehension, it should be distinctly understood that the higher institutions of learning here represented are not necessarily the twenty largest or the twenty leading universities, but all are in-

	California.	Chicago.	Columbia.	Cornell.	Harvard.	Illinois.	Indiana.	Johns Hopkins	Leland Stanford, Jr.	Michigan.	Minnesota.	Missouri.	Nebraska.	Northwestern.	Ohio State.	Pennsylvania.	Princeton.	Syracuse.	Wisconsin.	Yale.
College Arts, Men....	490	569	493	} 726	2077	302	923	158	800	742	470	284	330	371	271	} 514	732	} 942	732	1251
Colleg Arts, Women	943	812	399		444	305	596	......	478	635	745	133	608	421	200		......		525	......
Scientific Schools*...	840	......	719	1317	547	797	§	......	§	8 1	524	253	382	§	720	540	586	264	705	845
Law	80	89	384	235	734	140	95	......	198	823	430	180	170	210	159	324	......	125	194	255
Medicine	118	147	669	355	380	669	25	278	......	448	265	80	59	512	......	472	......	140	......	144
Agriculture	†	......	......	135	19	285	......	......	......	......	700	67	98	......	151	......	......	......	496	......
Art	206	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	49	......	33
Dentistry	112	......	......	......	115	585	......	......	......	74	140	......	19	500	......	363	......	......	......	......
Divinity.	......	177	......	......	50	......	......	......	......	......	......	......	......	150	......	......	......	......	......	98
Forestry	......	......	......	......	......	......	......	......	......	......	......	......	......	......	21	......	......	......	......	64
Music	......	......	......	......	......	93	......	......	......	......	......	......	320	318	......	22	......	579	227	80
Pharmacy.	84	......	......	......	......	183	......	......	......	56	46	......	......	217	47	......	......	......	32	......
Teachers College......	‡	95	624	......	......	......	......	......	......	......	......	84	......	......	......	165	......	‡	......	......
Veterinary	......	......	......	85	......	......	......	......	......	......	......	......	......	......	84	75	......	......	......	......
Graduate Schools	207	442	620	177	394	104	73	194	86	69	75	42	88	43	27	195	116	46	95	346
Summer Session.......	868	2244	1001	470	1392	225	479	......	18	523	175	639	191	......	104	......	......	52	400	......
Other Courses...........	32	......	17	157	......	72	......	65	......	......	......	......	......	100	35	......	......	110	......	15
Deduct Double Reg..	(290)	(429)	(369)	(219)	(139)	(99)	(577)	(1)	(210)	(245)	(20)	(222)	(18)	(102)	(109)	(26)	......	(100)	(185)	(141)
Grand Total..........	3690	4146	4557	3438	6013	3661	1614	694	1370	3926	3550	1540	2247	2740	1710	2644	1434	2207	3221	2990
Teaching Staff.......	342	197	585	420	549	399	71	150	128	182	295	106	220	304	140	308	108	180	225	325

*Includes schools of engineering, chemistry, architecture, mining, and mechanic arts.
† Included in scientific schools.
‡ Included in college statistics.
§ Included in college statistics.

stitutions of national repute. The figures have been obtained from the proper officials of the universities concerned, and are as accurate as statistics of this nature can be made. Changes are constantly taking place in the enrolment at most of these institutions, but they are not far-reaching enough to affect the general result.

According to the revised figures of last year, the nineteen universities enumerated ranked as follows:

Harvard, Columbia, Chicago, California, Michigan, Minnesota, Cornell, Illinois, Wisconsin, Northwestern, Yale, Pennsylvania, Nebraska, Syracuse, Indiana, Leland Stanford, Missouri, Princeton, Johns Hopkins. Comparing this with the present order, we shall find that there has been no change in the relative positions of the three largest universities, Harvard, Columbia and Chicago, but that Michigan has passed California, while Illinois has passed both Minnesota and Cornell. Wisconsin occupies the same position as last year, but Yale has passed Northwestern. Pennsylvania, Nebraska and Syracuse follow in the same order, Ohio State University, which is inserted for the first time this year, preceding Indiana, Missouri, Princeton, Leland Stanford and Johns Hopkins in the order named. The fact must not be lost sight of that numbers are not necessarily a criterion of general excellence or high standards, features with which this article does not attempt to deal. However, the fact that a university like Johns Hopkins is included in the statistics will prove that mere numbers have not unduly influenced the selection of the institutions here tabulated.

As far as the changes in the enrolment of the different universities are concerned, Harvard shows a considerable net increase, due almost entirely to the expansion of the summer session from 945 in 1902 to 1,392 in 1903. This increase must be attributed in large part to the Convention of the National Educational Association held in Boston early in July. Harvard's law school shows a gain of almost 100, thus eloquently demonstrating that increased standards of admission to the professional schools are not kept waiting long for merited recognition from the student body.

To be sure, the Harvard Medical School shows a loss of 65 as compared with last year, owing in part to the operation since 1901 of the requirement of a baccalaureate degree, or its equivalent, for admission, but we shall see below that this loss in the medical school enrolment may be due to other causes. Harvard College and the Lawrence Scientific School show a slight falling off over last year, while there has been a gain in the divinity school and the graduate faculties.

At Columbia also the increase in the total enrolment is due almost entirely to the growth of the summer session, the attendance at which increased from 643 in 1902 to 1,001 in 1903. The registration of the law school shows a falling off of 81, due to the requirements of the baccalaureate degree for admission for the first time this fall. The attendance at the school of medicine has decreased over 100, a loss that can in large part be attributed to increased standards for admission. With the opening of the present academic year, higher entrance requirements went into effect, whereby the minimum condition for admission to this faculty consists not, as heretofore, in the passing of examinations conducted by the regents of the university of the state in certain specified subjects, and the obtaining thereby of a medical student's certificate, but in the passing of an examination conducted either by the College Entrance Examination Board or by the Committee on Entrance Examinations of Columbia University. In every case the increase in requirements has had a gratifying effect on the quality of the first-year class. The graduate schools of Columbia University are growing very rapidly and show an increase of more than 100 over 1902. The extension students, of which there were 1,196 in 1902, have been omitted in this year's table, but even if the extension students were included, Columbia's registration would not be as large as that of Harvard.

The figures of the University of Chicago point to a slight decrease in the total enrolment, most of which is due to a falling off in the college and the faculty of medicine. The summer session shows a loss of over 100, but, as is well known, the summer session at the University of Chicago does not bear the same relation to the remaining terms as it does at Harvard or Columbia and most of the other institutions here represented, being regarded as a regular semester fitting into the scheme of the entire year's work.

The attendance at the University of Michigan has increased somewhat over last year, the largest gains being found in the scientific schools and the summer session. The faculties of law, dentistry and pharmacy all show a falling off. Of the 448 medical students, 66 are enrolled in the homeopathic division. In the case of the University of Michigan, as well as of several others, no accurate figures could be obtained for the number of summer session students who returned for work in the fall and who should be deducted under double registration. In all such cases the deduction is based upon a fair estimate.

The increase at the University of California is only slight, there being a loss in medicine and dentistry and in the college and scientific schools, which loss, however, is more than compensated for by slight gains in other departments.

In the case of the University of Illinois the gain of over 700 must be attributed chiefly to the fact that the Chicago College of Dental Surgery, formerly an independent institution, became a part of the university at the beginning of the year. However, there has been considerable gain in the scientific school and the department of agriculture, whereas the increase in the

attendance at the medical school is scarcely worth mentioning.

The increase at the University of Minnesota is small and is to be found almost entirely in the department of agriculture. The slight decrease in the number of male college students is more than made up by the increase of the number of women enrolled in the college. The law school has remained stationary, the scientific schools show an increase, and the medical faculty, the departments of dentistry and pharmacy, the graduate schools and the summer session, show a falling off in attendance.

At Cornell there has been a slight increase in the total attendance, and the typhoid epidemic of last year has apparently not affected the attendance to any great degree. There has been a decrease in the college, the faculty of medicine and the graduate schools. The department of forestry has been abolished and the summer session shows a decrease over last year. In the case of Cornell, also, the total is not quite accurate, inasmuch as no exact figures were given with regard to double registration.

Wisconsin shows considerable gains all along the line, with the exception of the graduate schools and the law faculty, the total enrolment being more than 300 in excess of that of last year.

The attendance at Yale has also increased over last year, the gains appearing in the college, the Sheffield Scientific School and the department of forestry. The medical and the graduate schools have remained stationary, while the law school and the schools of art, music and divinity show a decrease in enrolment.

There has been a decrease in the attendance at Northwestern University, a considerable portion of which is to be found in the faculties of medicine and dentistry. This decrease in attendance at the medical school may be attributed to two causes, namely, increased tuition and higher standards of admission. The 100 students listed under 'Other Courses' are students in oratory. The college and the law school show an increase, while the graduate schools, the divinity school and the department of pharmacy have remained stationary.

Pennsylvania shows a slight increase in the net total enrolment, due almost entirely to gains in the college and scientific schools. Law and dentistry have fallen off, whereas medicine and the graduate schools have remained stationary. The 165 students appearing under 'Teachers College' are attending courses for teachers.

At the Universities of Nebraska and Indiana there has been a slight decrease; Leland Stanford, Jr., has remained virtually stationary; while Syracuse, Missouri, Princeton and Johns Hopkins show an increase over the attendance of last year.

Comparing the attendance in the various departments with the figures for last year, the most striking fact is the decided decrease in the schools of medicine all along the line. In a number of institutions increased requirements have had something to do with this loss, yet the higher standards of admission alone can not be held accountable. The question arises whether this loss may not be due to a circumstance to which Professor Brouardel, of Paris, points in a recent investigation. He claims that the superabundance of physicians going hand in hand with a shortage of patients must be attributed to a decrease in the number of illnesses, a decrease due to the application of modern methods of preventive medicine.* The increase in the cost of procuring a medical education no

* Cf. Walter B. James, 'The Old and the New Medicine,' *Columbia University Quarterly*, Vol. VI., No. 1, p. 13. At McGill University, Montreal, Canada, the enrolment in the medical school also shows a decrease.

doubt is partly responsible, as well as the long time required for a thorough course.

The number of scientific students is still on the increase. In most of the other faculties there have been no consistent gains or losses, the decrease in certain universities being made up by a corresponding increase in others. Columbia University still has the largest enrolment in the graduate schools, with Chicago second, Harvard third and Yale fourth. The University of Michigan continues to head the list in the number of law students, followed by Harvard, Minnesota and Columbia in the order named. Although the attendance at the Columbia medical school has suffered a loss of over 100, this university still has the largest enrolment of any of the medical schools enumerated, but is closely followed by Illinois, with Northwestern and Pennsylvania occupying third and fourth places respectively.* As to the scientific schools, Cornell is in the lead, with Yale second, California third and Michigan fourth. Harvard has by far the largest collegiate enrolment and also had the largest summer session last year. As to the relative ranking of the teaching force in the largest institutions, Columbia now occupies first place, with Harvard second, Cornell third and Illinois fourth.

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* The table credits Columbia and Illinois with 669 students each, but in the case of Columbia there are a number of fourth-year college students enrolled in the medical school who do not appear among the 669, but in the primary registration under the college.

VARIATIONS INDUCED IN LARVAL, PUPAL AND IMAGINAL STAGES OF BOMBYX MORI BY CONTROLLED VARYING FOOD SUPPLY.

ONE of the races of the mulberry silkworm, *Bombyx mori,* has been the subject of experiments directed toward a determination of the exact quantitative relation which quantity and quality of food bear to the development and variations of the individual insect and its progeny. Such an experiment, on the face of it, might seem to be a laborious task having no further justification than the superfluous, though specific, demonstration of the axiom that the well-nourished are the well-developed. The writers will not hesitate, however, to put on record authentically determined data showing just how definite and constant is the relation for one animal species between varying nutrition and variations. As a matter of fact the experimental breeding and rearing and the accumulation of quantitatively determined data refer to several problems besides the few discussed in this paper. The successive years of breeding have left us at the present moment with a large number, several thousand, of eggs, due to hatch next March, which are the results of selected mating, and of which the ancestors for two or three generations are known, quantitatively described, and preserved for reexamination, if necessary. In addition to the knowledge of the structural and physiological characters (duration of various life-stages, etc.) of these ancestors, the quantitatively determined life-conditions, normal and experimentally varied, are known. These thousands of the fourth generation should afford us exact evidence, for this animal species, touching the prepotency of sex, of sports, of particular characters and of vigor, as well as evidence regarding fertility in relation to age, and evidence concerning genetic and physiological selection.

The present statement is limited to an outline of the results of only those experiments relating directly to the influence exerted by varying conditions of food supply.

The insect, *Bombyx mori,* has a complete metamorphosis, taking no food as an adult,

so that the experimental control of the feeding has been necessary only during the larval or 'silkworm' stage. The larval life is subdivided into five stages clearly set off from one another by the intervening moults, of which there are normally four, and these substages have been useful when an alteration of food conditions during a sharply defined shorter time than the entire larval life was desirable.

The change in quality of food has consisted in a substitution of lettuce for the silkworm's proverbial mulberry diet. The change in quantity of food has consisted in altering the amount of mulberry served to the larvæ, the control of which has been secured as follows: It has been determined through experience with normal larvæ that each will consume a certain amount of food in a certain number of hours (increasing in amount with the increasing age and size of the larva), this amount representing the optimum amount of food for the normal individual and necessitating as many daily meals as are required to keep any but the moulting larva constantly supplied with fresh food. This amount determined, a tolerably definite small proportion of the optimum amount has been allotted the individuals which were sentenced to short rations, which, roughly speaking, might be listed as one quarter the optimum amount during earlier stages and one eighth during the late larval stages. This one fourth, one eighth or whatever it may have been numerically, was, at any rate, as small an amount of food as was compatible with mere life. Our object was not that any of the larvæ should die of starvation, but that they should live to tell the tale of the results of diminished nourishment. This difference in feeding was not regulated by lengthening the intervals between meals, but by giving the under-fed but a scanty share of the quantity afforded the well-fed individuals at each meal. There were no intervals between the meals of the well-fed, whereas there were lengthy intervals between the meals of the under-fed, because the under-fed very promptly ate their allotments and were, therefore, without food during the remainder of the interval preceding the next feeding time.

These experiments have extended over a period of three years, covering as many generations of the insect. The data gathered (being the measurements, weight and duration of each larva in each of its five stages; the time of spinning, weight of silk and weight and duration of each pupa; and the weight, size, pattern and fertility of female of each imago) furnish material, then, for a study of the effects of underfeeding upon individuals during a single generation (the 1903 generation or that of 1902 or 1901), during two successive generations (1901–02 or 1902–03), and two alternating generations (1901, 1903) and during three generations (1901–03), a control lot having been carried for each experimental lot so that what is modified may confidently be distinguished from what is normal.

The practice of isolating the larvæ individually has been observed for some of the lots of 1901 and for all the individuals in all the lots of 1902 and 1903. The necessity for such an arrangement will be appreciated by making comparison of a lot of isolated individuals with a lot of individuals getting a living in a single tray where competition became a factor, the amount of food per capita being identical for the two lots.

In 1901, two lots, each consisting of twenty larvæ, were reared on very short rations, the first lot having its individuals isolated, the second having all of its individuals in a single tray. The amount of food per capita allowed these two lots was identical—an amount calculated to produce dwarfs. After the second moult,

when the larvæ were about nineteen days old, we found the first lot very uniform and the second very unequal in size, the difference between the heaviest and lightest in the first lot being 19 mg. as against 45 mg. in the second. To the second lot belonged the smallest individual among the season's entire generation of worms, while, on the other hand, this competitive lot boasted one precocious individual weighing more than the average among other lots of well-fed worms, holding, indeed, third place among the 'heavy weights' of the season.

The records of size, when these larvæ had finished feeding and were ready to spin, show the final results of the competitive and non-competitive life of the under-fed lots: in the first lot, with the individuals isolated, the difference in weight between the largest and smallest was 229 mg., in length 8 mm.; in the second, with the individuals together and competing, the difference in weight was 901 mg., in length 22 mm. These figures speak for themselves and offer a pretty illustration of the non-combative but equally strenuous struggle for existence which occurs when an inadequate food supply results in a struggle between closely allied and hence competing forms, to the prosperity of some and the decline of other members of the species thus divided against itself.

A second reason for isolating the larvæ individually is that individual records extending over long periods of time are not otherwise possible. The data consist of individual records concerning Characters, in part enumerated below, of 630 individuals of *Bombyx mori* belonging to three generations (1901–03).

The studied characters which are pertinent to the present discussion may be listed as follows:

1. Those relating to *size* as indicated by weight of larva, of the cocooned pupa, of the cocoon or pupa alone and of the adult upon emergence.

2. Those relating to the prompt performance and normal occurrence of physiological functions such as the moulting and spinning of the larva and the emergence of the adult.

3. Fertility in so far as it is indicated by the number of eggs laid.

4. Mortality among the variously nourished lots as indicated by the death rate.

Some generalizations already reached through the study of the data may be briefly summarized as follows:

1. As to the substitution of lettuce for mulberry as silkworm food, the experiment has been tried only with the generation of 1903, and that on a rather small scale. The 'worms' have adapted themselves to this change of diet to the extent of living successful individual lives and of producing eggs which bear all the earmarks of fertility, that is, have gone through the normal change of color from yellow to gray, the result of beginning development. The eggs will not hatch until March, 1904. The young larvæ adopted the unusual diet very reluctantly, but in later life these same larvæ, 'educated' to its use, ate lettuce with a relish which would rival that displayed by the normal larva with its mulberry leaf.

The most striking variation induced by this lettuce regimen was that the time consumed by the metamorphosis was double the time appointed for that of the normal mulberry-fed larva—being three months as compared with six weeks for the latter. In the commercial world this fact would offset the advantage of the lettuce, as a cheaper food and as one available at all seasons, by demanding twice the labor that is required to rear to spinning time larvæ fed on mulberry. Thus it appears that the lettuce experiment can not be of economic value to sericulture unless it should prove

that lettuce-made silk is worth the cost of double labor.

The other variations noted among the lettuce-fed 'worms' have to do with the larva and cocoon. All of the lettuce-fed larvæ appeared to be unusually 'thin skinned,' the body wall being stretched and shiny. The larvæ were at all stages characteristically heavier than mulberry-fed larvæ, each of them weighing at spinning time as much as, and two of them weighing 400 mg. more than the heaviest of the mulberry-fed. The weights of the cocooned pupæ were somewhat above the average among the mulberry-fed, a fact due to the large pupa rather than to the amount of silk in the cocoon, as was demonstrated by weighing cocoon and pupa separately, whereupon it was found that the cocoon was, on the average, but one half as heavy as that of the average among the mulberry-fed, in some cases falling as low as two fifths of the mulberry cocoon's average weight, and in no case rising above three fifths. The silk appears to be less strong and elastic than that of the mulberry-made cocoon.

2. In the mulberry-fed worms there exists a very definite and constant relation between amount of food and size as indicated by weight, the starveling individuals being consistently smaller than the well-nourished, the lingering effects of this dwarfing being handed down even unto the third generation, although the progeny of the famine generation be fed the optimum amount of food; in case the diminished nourishment is imposed upon three or even two successive generations there is produced a diminutive, but still fertile, race of Lilliputian silkworms whose moths, as regards wing expanse, might join the ranks of the micro-Lepidoptera almost unremarked.

In illustration may be quoted the typical or modal larval weights for each of the lots of 1903 at the time of readiness to spin, which marks the completion of the feeding and is, therefore, an advantageous point for a summary of the results of the three years' experimental feeding.

The history of the eight lots referred to may be gathered from an examination of the accompanying table, in which 'O' means optimum amount of food and 'S' means short rations. The column to the right indicates the relative rank of the various lots as judged by the modes of frequency polygons erected to include all the individual weights for each lot at spinning time.

Lot Number.	History of Lots.			Modal Rank. 1903.
	1901. Grandparents.	1902. Parents.	1903.	
1	O	O	O	1
2	O	O	S	6
3	O	S	O	3
4	O	S	S	7
5	S	O	O	2
6	S	O	S	5
7	S	S	O	4
8	S	S	S	8

We find that control lot 1, consisting of normally fed individuals of normal ancestry, holds first rank in weight, as was to be expected. Second comes lot 5, whose grandparents experienced a famine but whose parents as well as themselves enjoyed years of plenty. Lots 2 and 3 have likewise had one ancestral generation on short rations, and the fact that they are lighter in weight than lot 5 illustrates a general rule which obtains throughout the entire company of experimental worms, namely, that the effects of famine grow less evident the further removed the individuals are from its occurrence in their ancestral history. Thus lot 5 is two generations removed from the famine of 1901, while lot 3 has had but one generation in which to recover its ancestral loss. Lot 2, which has had a total of but one famine year—the current year—nevertheless ranks

below lot 7, which has had two famine years in its ancestry succeeded by plenty during the current year. Lot 2 also ranks below lot 6, a fact which appears strange, considering that lot 6 has suffered two generation of famine, including the current year, which is the only famine year experienced by lot 2. In explanation of this anomalous condition it is suggested that possibly the larvæ of lot 6 were better fitted for enduring and making the best of hard conditions than were the individuals of lot 2, the ancestors of the former lot having been selected two years ago on a food-scarcity basis. This suggestion gathers support from an inspection of the mortality notes, from which it appears that the number of deaths —for which the famine was probably a contributing and not a primary cause—in each lot which is for the first time subjected to short rations is almost doubly greater than the number of deaths in lots which are descended from starved ancestors, whether these ancestral famines occurred in successive or alternate years. The figures indicate that a reduction of food is almost twice as destructive upon the first generation which is subjected to it as it is when visited on a second generation. Lot 4 follows lot 2 as the seventh in rank and its position is in accord with the rule above noted, its latest ancestral generation which enjoyed an optimum amount of food having been grandparental, whereas the ancestors of all the other lots except lot 8 have had the optimum amount of food during 1902 or 1903. Lot 8 holds lowest rank, it and its ancestors having been subject to trying conditions throughout the entire three years, during some one or two of which all the other lots have enjoyed the best of food conditions. Thus it appears that a generation of famine leaves its impression upon at least the three generations which succeed it, yet the power of recovery through generous feeding exhibited by the progeny of individuals subjected to famine is so extensive (witness lot 5) that it appears probable that every trace left by the famine upon the race would eventually disappear. It is even conceivable that the ultimate result of the famine would be a strengthening of the race, the famine having acted the part of a selective agent, preserving only the strong.

But although there is a large difference between the well-fed and the poorly fed, there persists, more obviously in late than in early life, a very considerable discrepancy as to size among the individuals of each single lot whose environment, in so far as food, temperature, room, humidity, etc., constitute it, is identical.

For example, referring again to the weights at spinning time of the larvæ of 1903, it is true that although each lot has a modal class of weights to which the majority of its individuals belong and about which the rest of the lot distributes itself rather symmetrically, the extremes are surprisingly distant from one another. Thus in lot 1 (the normal control lot) the extremes are 1,540 and 2,530 mg.; in lot 2,* 800 and 1,402 mg.; in lot 3, 1,180 and 2,170 mg.; in lot 4, 690 and 1,204 mg.; in lot 5, 1,370 and 2,100 mg.

That is to say, identical feeding has not made identical full-grown larvæ out of individuals which undoubtedly varied *congenitally* at the start, those variations—in embryo—standing at birth in the same relation to one another that they stand in the adults, having merely been *smaller* and less readily discernible in early life, although manifestly present in delicately measurable degree in the earliest records made upon normal individuals. For example, weight measurements taken immediately after the second moult range in one lot from 21 to 39 mg., or 60 per cent. of the modal weight, while the weights in this same lot at spinning time,

* See table, page 746, for the history of each lot.

some five weeks later, range from 534 to 2,080 mg., or 85 per cent. of the mode for the lot. These embryonic but potentially large variations have simply 'grown up' along with the insect and are as truly congenital in the adult as they were in the newly hatched larva. This would seem to place quite conclusively in the category of congenital variations some part of those variations (in size and proportions of parts) which are commonly, and properly to some degree, called acquired.

3. That conditions of alimentation bear a directive relation to functional activity may be demonstrated by reference to the records of the physiological functions of moulting, spinning, pupating and emerging, of the individuals of the experimental lots.

An abnormal extension of the time needed for the metamorphosis follows upon a reduction of the food supply. The degree of extension depends with the utmost nicety upon the amount of food given the larvæ. For example, among the 1901 generation of silkworms, one control lot of twenty larvæ was given the optimum amount of food, a second lot of twenty larvæ one half this amount, and a third lot of twenty larvæ one quarter of the amount. To take the time of the fourth moulting as an illustration, the moulting was begun by the first lot, which led the way by two and a half days, at the end of which the second lot began to moult, while the third lot was twenty-four hours behind the second. All the individuals of the first lot had finished moulting on April 20, all of the second on April 24, while the moulting in the third lot continued until April 29.

As in the matter of weight, this retarding of the functions, by means of a reduced food supply, affects not only the immediate generation which is subjected to the famine, but the lingering effects of it may be traced in the progeny of the dwarfed individuals at least unto the third generation, even though two years of plenty follow the one year of famine. The conditions which obtain in each lot of individuals of the 1903 generation at spinning time are shown in the accompanying table, which is based upon polygons erected to include all the individuals in each lot.

Lot Number.	History of Lots.			Rank of 1903 Lots as to Promptness in Spinning.			
	1901. Grandparents.	1902. Parents.	1903.	Earliest Spinner.	When Two-thirds of Each Lot were Spinning. Date.	In Order of Rank.	Latest Spinner.
1	O	O	O	1	May 12	1	1
2	O	O	S	5	" 25	4	4
3	O	S	O	2	" 13	2	3
4	O	S	S	4	" 26	5	5
5	S	O	O	3	" 13	2	2
6	S	O	S	6	" 29	6	7
7	S	S	O	6	" 22	3	5
8	S	S	S	7	" 30	7	6

This period in the life of the silkworms is particularly advantageous for consideration here because it marks the completion of the feeding, so that the individuals of under-fed ancestry have been given the best chance to recover, while those subject to altered food conditions have had the benefit of the alteration during the entire food-taking period of life.

In the table 'O' means optimum amount of food and 'S' means short rations. To the right of the history of the lots is a section showing the rank of the lots as to the extreme time limits of the spinning

time (emphasized congenital differences again), with a safer criterion, as to their relative promptness, in the column between the extremes—a column of figures intended to show the relative promptness with which a two thirds majority of the larvæ in each lot arrives at the spinning time, this proportion being taken to represent the typical condition for the lot. The order in which the lots are arranged in this column corresponds in a general way with that prevalent for the weights at spinning time, and the generalizations indulged in there may with few exceptions be applied here. The lots which were well fed during the 1903 generation are ahead of all of those given short rations in 1903, whatever ancestry they may have had. Lot 1 leads here as in the matter of weight. Lots 3 and 5 tie for second place, having held second and third places in weight. Lots 2 and 4 stand in the same relation to one another that they held as to weight. Contrary to the weight relation, lot 6 follows lot 2 at the spinning—a fact which illustrates again the general rule that two generations of famine are more disastrous than one, but does not lend support to the notion of natural selection on a food scarcity basis as previously suggested. Lot 8, which has had no relief from famine during the entire three years, brings up the rear at the spinning, as might be expected.

This check upon functional activity exercised by diminished nourishment affects the moulting, the time for the commencement of spinning and the issuing time for the adults, but the time spent in the spinning of the cocoon, from its beginnings in the threads of the supporting net to its apparent completion when the cocoon becomes opaque, is practically identical for under-fed and well-fed individuals. A reason for this exception to the tardy habits of the under-fed is to be found in the fact that the under-fed larvæ produce less silk (less in size, thickness and weight) than the well-fed, thus accomplishing more meager results in the same amount of time. That the individuals sentenced to short rations should produce less silk than their well-fed neighbors is certainly to be expected, silk not being made without leaves any more readily than bricks without straw.

4. Not only do short rations protract the time appointed for the spinning, moulting, etc., but they appear to have a more striking effect upon the actual occurrence of the moulting. The normal number of moults for the silkworm larva is four. Five moults have occurred for most of the individuals belonging to the under-fed lots of 1902 and 1903, whereas none of the well-fed individuals has undergone a fifth moult. It would seem, therefore, that the occurrence of a fifth moult may be fairly ascribed to a reduction of food; at least a fifth moult very frequently accompanies it and has suggested the possibility that the enforced fasting of the under-fed larva—in the intervals between meals—may have the same physiological effect as the normal fasting which precedes the normal moulting, during which time the so-called 'moulting fluid' is secreted. That this effect may accumulate throughout the lifetime of the larva until the larva is actually forced to indulge in the extravagance (of strength, feeding time and body wall material) of an additional moult is conceivable and will justify a further test.

5. As to the life and death selection due to famine, it may be said, in addition to the previous discussion of mortality among the experimental silkworms, that while lots subjected to two years of famine (themselves in one year, their parents in the year before) were fertile in so far as number of young hatched is concerned, it was found to be exceedingly difficult to rear from them a 1903 generation. Indeed, at the time of the second moulting there were but

nineteen individuals (and tolerably vigorous larvæ they were) alive in the lot which had experienced two years of famine, although every individual of the 149 hatched was carefully preserved and royally fed – a fact which goes to prove that the equipment at birth of many of these larvæ was inadequate.

The fact that some larvæ of starved ancestry have exhibited a superiority over their fellows, in surviving and recovering from hard conditions, is testimony for the existence of individual variations which can not be defined anatomically, and yet which serve as 'handles' for natural selective agents. Such variations might be called physiological variations, since it seems that the surviving larvæ must be those which are in best trim physiologically. These larvæ are able to make the most of the food offered to them. If competition were allowed, they would probably be the individuals which would cover the area most rapidly, securing whatever food there might be. But under our experimental conditions there was no competition allowed and yet certain precocious individuals made more grams of flesh and more yards of silk, than other larvæ furnished with the same amount of raw material under like conditions; that this was due to the possession by the former of certain congenital qualities of adaptability can scarcely be doubted.

6. As to the fertility of the variously fed lots; in so far as number of eggs produced is a measure of fertility, our records already demonstrate the fact that the better nourished are the more fertile. Furthermore, the economy in this matter practised by the starvelings is not merely numerical, quality as well as quantity of eggs being affected. In witness of this point may be recalled the story of the dying 1903 generation, produced from eggs of the starvelings of 1901 and 1902, which would seem to offer conclusive evidence that a famine suffered by the parents works its way into the germ cells so that most of their progeny have but a poor birthright.

A more exhaustive study of silkworm fertility and its correlation with anatomical variations and physiological vigor has been begun, and when it is carried to the point of indicating not only how many eggs are laid but how many eggs develop through larval and pupal stages into fertile adults, some clear light may be thrown upon such questions as that which arises concerning the precise ancestry of the survivors of our induced famine and the part these survivors will play in race history.

V. L. Kellogg,
R. G. Bell.
Stanford University.

SCIENTIFIC BOOKS.

RECENT PSYCHOLOGICAL LITERATURE.

The lack of an adequate history of the remarkable developments in psychology during the last quarter century has been keenly felt in many directions and not least by the psychologists themselves. The task of supplying this need is peculiarly difficult. For its successful accomplishment one must possess not only the rare gift of lucid and accurate exposition, but one must also be a competent philosophical scholar, with a considerable knowledge of biology in addition to a wide and exact acquaintance with the many phases of psychology itself. The fulfillment of these trying requirements has been in effect essayed by Guido Villa, of the University of Rome.* His book is not entitled a history, but in substance it is such, being an effort to give, in connection with comments upon the work of various authors, a correct impression of the general drift of contemporary psychology.

It must be admitted that the book is superior to anything else at the moment available. It represents an immense amount of patient en-

* 'Contemporary Psychology by Guido Villa' (translation by Harold Manacorda), Swan Sonnenschein & Co., London, 1903, pp. xv + 396.

deavor and it is marked throughout by an evident fairness of spirit, for all of which the writer deserves appreciation and credit. Moreover, it is, on the whole, clear, the author being at his best in dealing with the more philosophical aspects of his subject. The translator has done his work acceptably. Nevertheless the book suffers from several serious defects. Thus, for example, although much space is devoted to the description of Wundtian doctrine, the portrayal of the methods and results of experimental psychology is distinctly inadequate. No one could possibly gain from it a just conception of the scope and solidity of achievement of this branch of psychological work. Morbid psychology, animal psychology and the psychology of religion are even more gravely misevaluated. Needlessly distressing are the misprints which deface almost every page, distorting dates, rendering proper names in some cases almost unrecognizable, etc. An exasperatingly incomplete index furnishes the climax of this kind of annoyance.

Professor Royce has put aside his metaphysics long enough to write an admirable psychology, which is ostensibly constructed for teachers, but will undoubtedly find a much wider public.* Indeed, it will probably be only the better trained teachers who will successfully follow the text, for the author has written with something of his usual fullness and freedom, and the average pedagogue commonly demands his intellectual pabulum cut up in smaller pieces than those here offered. Several novel features appear in the construction of the book, which is extremely suggestive, and characterized throughout by a strong flavor of practical common sense.

In the first place, the author has abandoned the conventional lines of division of the psychological field into cognition, feeling and will. In their stead occur the categories of 'sensitiveness,' under which are included feeling and sensory discrimination: 'docility,' in connection with which we find discussions of the multifarious influences of past experience upon the consciousness of the present moment; and 'mental initiative,' under which we are confronted with those facts which indicate a factor of variation and individual peculiarity entering into our mental operations. These rubrics are in essence, perhaps, variants upon current usage rather than wholly original, but they undoubtedly serve to avoid certain perils to which the customary method of division is exposed and they facilitate the practical applications of a broadly pedagogical character which the author desires to make.

An entirely novel doctrine, so far as I am aware, is, however, advanced in connection with the theory of feeling. As is well known, pleasure and displeasure have long held sway as the sole rudimentary forms of feeling. Wundt has recently contended for two other elementary polar groups, *i. e.*, feelings of excitement and depression and feelings of tension and relief. Professor Royce proposes *two* fundamental groups, *i. e.*, pleasure and displeasure, restlessness and quiescence. Space does not permit an examination of the merits of this program. Suffice it to say, that the deficiencies of the pleasure-displeasure classification as usually advocated are increasingly evident, and in the reconstruction which appears to be immediately at hand Professor Royce's proposition may prove to be as near the mark as any. He seems to be unaware of the support afforded such a theory as his own by the physiological observations of Binet, Courtier, Vaschide, Thompson and the reviewer.

Another striking feature of the book is the attempt to connect the phenomena of mental initiative and variation with such organic reactions as those to which Loeb and others have given the name of tropisms. The point which our author wishes to make is the recognition of a type of spontaneity independent of the individual's own past experience and independent of the usual hereditary factors of the instinct variety. That the two groups of phenomena are analogous to one another hardly admits of doubt, but in identifying the two activities so closely Professor Royce has surely allowed his first enthusiasm to carry him

* 'Outlines of Psychology, An Elementary Treatise with Some Practical Applications,' by Josiah Royce, The Macmillan Company, New York, 1903, pp. xxvii + 392.

beyond the definite implication of the facts at present known. Save in the case of obviously morbid conditions there is never any such persistent adherence to impulses operating independent of, or counter to, the influence of the individual's past experience as that manifested by the true physiological tropisms. A genuine mental variation from type must be recognized and provided for in our psychology, but to do this it is neither necessary nor altogether permissible to invoke the tropism concept in an unmodified form.

Another agreeably written book for teachers comes from the hand of Dr. Judd.* It is practically a series of essays dealing with certain of the contact points between psychology and education. The keynote of the book is the principle of development through expression, which the author dwells upon in an illuminating way in its psychological and practical aspects. The elementary school problems centering about reading, writing and arithmetic are discussed in the light of this principle and a number of instructive and interesting experiments and observations are reported. The volume does not belong to an order of books in which startling originality is feasible, but it is informed throughout with admirable good sense; it is suggestive on specific concrete points and it is thoroughly intelligible to even the casual reader, so that it ought to be found a very useful addition to the resources of those for whom it has been prepared.

Experimental psychology has had its apologists and its popularizers. Professor Stratton is, however, the first to attempt on an extensive scale the exhibition of its bearings upon our general philosophical and intellectual interests. † His book, which is written in a forceful and attractive style, is addressed primarily to the intelligent and serious-minded person who cares to keep in touch with the scientific developments of his own day, especially the broader and more distinctly cultural implications of those developments. Experimental investigations (a number of them original) have been selected for discussion, which bear directly upon such problems as those of the existence of unconscious ideas, the nature and reality of personal identity, the character of time and space, the connection of mind and brain, etc. The exact procedure in typical psychological experiments is vividly described in connection with copious photographs and drawings, so that even the veriest tyro may obtain a correct impression of the technique in such work. The general treatment, although fresh, vigorous and independent in its temper, is conservative and trustworthy, following in the main the lines of commonly accepted theories. Although there may be some disappointment that the results gained from experiment do not speak with a tone of greater finality upon the philosophical problems to which they are applied, there can be no question that the author succeeds admirably in showing how they contribute their quota of novel and reliable evidence in favor of one or another of the possible solutions of such problems. By reason of its interesting collocation of material, not to mention its other excellencies, the book is likely to prove as valuable to psychologists as to those outside the strictly psychological pale.

Despite the independent status of psychology, it is still true that its logical bases as well as its history must always keep it close to philosophy. Especially is it true that now and again its fundamental presuppositions and assumptions must be examined and tested. No problem of this general character is more insistent than that of the relation between the mind and the body. Experimental psychologists have largely come to adopt the position of psychophysical parallelism as a tentative working basis, frankly recognizing its limitations and defects. In view of the utter instability of opinion manifested by the controversial literature of the subject, this practical attitude is not difficult to understand. Professor Strong has just rendered yeoman service by setting in order the various pros and cons

* 'Genetic Psychology for Teachers,' by Charles Hubbard Judd, D. Appleton & Co., New York, 1903, pp. xiii + 329.

† 'Experimental Psychology and its Bearing upon Culture,' by George Malcolm Stratton, The Macmillan Company, New York, 1903, pp. vii + 331.

upon the matter.* He brings wide knowledge, unbiased judgment and unusual critical acumen to his task, and the result is a work of marked distinction. The various contentions of automatism, parallelism and interactionism are successively examined, and after the expurgation of all fallacies, the residuum of uncontroverted doctrine is elaborated into the theory of psychophysical idealism—a theory closely akin to the panpsychism of Fechner, Clifford and others.

Psychophysical idealism inverts the materialistic view, in accordance with which the brain is the reality and consciousness a mere unsubstantial phenomenon, and maintains that the mind is the reality—the thing-in-itself—of which the brain is the phenomenal manifestation. This sounds at first like a very naïve form of subjective idealism, offensive to all persons of Dr. Johnson's persuasion and to many others less strenuous. And idealism it is, but by no means naive in the arguments upon which it is based, including, as these do, scholarly considerations of the nature of causation and the law of the conservation of energy, discussions of the pertinent facts in physiological psychology, etc. An adequate critical analysis of Professor Strong's theory is evidently out of the question at this time. It should not be forgotten, however, that theories of this type, while avoiding the crass incongruities of the common forms of materialism, the inconsistencies of interactionism and the inconclusiveness of parallelism, are nevertheless incessantly haunted by the ghost of solipsism. If the solipsistic position be accepted, it then requires a constant miracle, of the kind resorted to by occasionalism, to account for the orderliness of the physical cosmos upon which we are all so unanimously agreed. Whether Professor Strong has wholly avoided the treacherous solipsistic pitfalls, the reader must decide for himself.

JAMES ROWLAND ANGELL.

*'Why the Mind has a Body,' by C. A. Strong, The Macmillan Company, New York, 1903, pp. x + 355.

SCIENTIFIC JOURNALS AND ARTICLES.

The Journal of Comparative Neurology for October contains five papers, as follows: (1) 'The Neurofibrillar Structures in the Ganglia of the Leech and Crayfish, with Especial Reference to the Neurone Theory,' by C. W. Prentiss. Establishes fibrillar continuity between the nerve elements, confirming in this respect the conclusions of Bethe and Apáthy. (2) 'On the Increase in the Number of Medullated Nerve Fibers in the Ventral Roots of the Spinal Nerves of the Growing White Rat,' by Shinkishi Hatai. The total number of medullated fibers in the ventral roots of the adult is 2.7 times that of the rat ten days old, and at all ages the total number of medullated ventral root fibers decreases from the spinal cord toward the periphery. (3) 'On the Medullated Nerve Fibers crossing the Site of Lesions in the Brain of the White Rat,' by S. Walter Ranson. Operations on very young rats heal with no appreciable scar and the site of the lesions is crossed by medullated fibers. These are presumably entirely new axones, for the power of regeneration seems to be lost in the adult. (4) 'On the Density of the Cutaneous Innervation in Man,' by Charles E. Ingbert. About 79 per cent. of the medullated dorsal root fibers innervate the skin and 21 per cent. are afferent fibers from muscles and deep tissues. One cutaneous spinal nerve fiber innervates, taking the average of the entire body, 2.05 sq. mm. of the skin. (5) 'On a Law determining the Number of Medullated Nerve Fibers innervating the Thigh, Shank and Foot of the Frog—*Rana virescens*,' by Henry H. Donaldson. The nerve fibers entering the leg being considered as so many separate lines of connection with the several segments, are found to be distributed in accordance with the law that the efferent fibers are present in proportion to the weight of the muscle, and the afferent in proportion to the area of skin.

SOCIETIES AND ACADEMIES.

THE CONVOCATION WEEK MEETINGS OF SCIENTIFIC SOCIETIES.

THE American Association for the Advancement of Science, the American Society

of Naturalists and the following affiliated societies will meet at St. Louis, Mo., during the week beginning on December 28.

The American Association for the Advancement of Science. The week beginning on December 28, 1903. President, The Hon. Carroll D. Wright; Permanent Secretary, Dr. L. O. Howard, Cosmos Club, Washington, D. C.; General Secretary, Dr. Chas. W. Stiles, U. S. Department of Agriculture, Washington, D. C.; Secretary of the Council, President Chas. S. Howe, Case School of Applied Science, Cleveland, Ohio. *Local Executive Committee*, President, Professor William Trelease; Secretary, Alexander S Langsdorf.

Section A—Mathematics and Astronomy. Vice-president, O. H. Tittmann; Secretary, Professor L. G. Weld, University of Iowa, Iowa City, Ia.

Section B—Physics. Vice-president, Professor Edwin H. Hall; Secretary, Professor D. C. Miller, Case School of Applied Science, Cleveland, Ohio.

Section C—Chemistry. Vice-president, Professor W. D. Bancroft; Secretary, Professor A. H. Gill, Massachusetts Institute of Technology, Boston, Mass.

Section D—Mechanical Science and Engineering. Vice-president, Professor C. M. Woodward; Secretary, Professor Wm. T. Magruder, Ohio State University.

Section E—Geology and Geography. Vice-president, Professor I. C. Russell; Secretary, Dr. G. B. Shattuck, The Johns Hopkins University, Baltimore, Md.

Section F—Zoology. Vice-president, Professor E. L. Mark; Secretary, Professor C. Judson Herrick, Denison University, Granville, Ohio.

Section G—Botany. Vice-president, Professor T. H. MacBride; Secretary, Professor F. E. Lloyd, Teachers College, Columbia University, New York City.

Section H—Anthropology. Vice-president, Professor M. H. Saville; Secretary, Dr. R. B. Dixon, Harvard University, Cambridge, Mass.

Section I—Social and Economic Science. Vice-president, Judge S. E. Baldwin; Secretary, J. E. Crowell, U. S. Department of Agriculture, Washington, D. C.

Section K—Physiology and Experimental Medicine. President, Professor H. P. Bowditch; Secretary, Professor F. S. Lee, Columbia University, New York. There will be no meeting of Section K at the St. Louis meeting.

The American Society of Naturalists. December 29 and 30. President, Professor William Trelease; Secretary, Dr. Ross G. Harrison, The Johns Hopkins University, Baltimore, Md. *The Central Branch* of the society meets at the same time and place. President, Professor John M. Coulter; Secretary, Professor W. J. Moenkhaus, Indiana University, Bloomington, Ind.

The Astronomical and Astrophysical Society of America. December 29, 30. President, Professor Simon Newcomb; Secretary, Professor Geo. C. Comstock, Washburn Observatory, Madison, Wis.

American Physical Society. During convocation week. President, Arthur G. Webster; Secretary, Professor Ernest Merritt, Cornell University, Ithaca, N. Y.

The American Chemical Society. December 28, 29. President, Professor John H. Long; Secretary, Professor W. A. Noyes, The Johns Hopkins University, Baltimore, Md.

The Geological Society of America. December 30, 31, 1903, January 1, 1904. President, Dr. S. F. Emmons; Secretary, Professor H. L. Fairchild, University of Rochester, Rochester, N. Y. *Cordilleran Section.* San Francisco. January 1, 2, 1904.

The American Mathematical Society—Chicago Section. Secretary, Professor Thomas F. Holgate, Northwestern University, Evanston, Ill. *San Francisco Section.* Berkeley, Cal. December 19. Secretary, Professor G. A. Miller, Stanford University, Cal.

Botanical Society of America. December 30, 31. President, B. T. Galloway; Secretary D. T. MacDougall, New York Botanical Garden, Bronx Park, N. Y.

The Central Botanists' Association. President, Conway MacMillan; Secretary, C. F. Millspaugh, Field Columbian Museum, Chicago, Ill.

The Botanical Club of the Association. Probably, at convenient times.

The Society for Horticultural Science. December 28, 29. President, Professor L. H. Bailey; Secretary, S. A. Beach, Geneva, N. Y.

The Fern Chapter. Time to be announced. President, B. D. Gilbert; Secretary, H. D. House, Botanical Garden, Bronx Park, New York, N. Y.

The Society for the Promotion of Agricultural Science. December 28, 29, 30, 31, 1903, January 1, 1904. President, Dr. William Frear; Secretary, Professor F. M. Webster, University of Illinois, Urbana, Ill.

American Society of Zoologists, Central Branch. December 29, 30, 31. President, Professor Jacob E. Reighard; Secretary, Professor Frank Smith, University of Illinois, Urbana, Ill.

The Association of Economic Entomologists. December 29, 30. President, Professor Mark V.

Slingerland; Secretary, Professor A. F. Burgess, Ohio State University, Columbus, Ohio.

The Entomological Club of the Association. At convenient times. President, E. A. Schwarz; Secretary, C. L. Marlatt, Department of Agriculture, Washington, D. C.

The American Microscopical Society. December. 28, probably. President, T. J. Burrill; Secretary, H. B. Ward, Lincoln, Nebraska.

Association of Plant and Animal Breeders. First general meeting. December 29, 30. Chairman of Committee, W. M. Hayes, University Farm, St. Anthony Park, Minn.

The American Anthropological Association. December 28, 1903, January 1, 2, 1904. President, Dr. W J McGee; Secretary, George H. Pepper, American Museum of Natural History, Central Park, New York City.

The American Psychological Association. December 29, 30. President, Dr. W. L. Bryan; Secretary, Professor Livingston Farrand, Columbia University, New York City.

The Sigma Xi Honorary Scientific Society. During convocation week. President S. W. Williston; Secretary, Professor E. S. Crawley, University of Pennsylvania, Philadelphia, Pa.

The National Educational Association, Department Presidents. About January 1, 1903. President, John W. Cook; Secretary, Irwin Shepard, Winona, Minn.

There will meet at Philadelphia:

The Association of American Anatomists. December 29, 30, 31. President, Professor G. S. Huntington; Secretary, Professor G. Carl Huber, University of Michigan, Ann Arbor, Mich.

The Society for Plant Morphology and Physiology. December 29, 30, 31. President, Professor Roland Thaxter; Secretary, Professor W. F. Ganong, Smith College, Northampton, Mass.

The Society of American Bacteriologists. December 29, 30. President, Professor H. W. Conn; Secretary, Professor E. O. Jordan, University of Chicago, Chicago, Ill.

The American Physiological Society. December 29, 30. President, Professor R. H. Chittenden; Secretary, Professor F. S. Lee, Columbia University, New York City.

There will meet at Princeton:

The American Philosophical Society. December 29 and 30. President, Professor Josiah Royce; Secretary, Professor H. N. Gardiner, Smith College, Northampton, Mass.

There will meet in New York:

The American Mathematical Society. Columbia University. December 28 and 29. President, Professor Thomas S. Fiske; Secretary, Professor F. N. Cole, Columbia University, New York City.

THE ACADEMY OF SCIENCE OF ST. LOUIS.

AT the meeting of November 16, 1903, twenty-three persons present, Professor A. W. Greeley, of Washington University, presented a report on experiments on the nature of the contraction of muscle. These experiments were undertaken with the view of working out more fully the mechanism involved in the galvanotropic and chemotropic reactions of *Paramœcia* in acid and alkaline media, as described in Professor Greeley's report before the academy last spring. In the experiments on the contraction of muscle, it was found that when the medusa, *Gonionemus*, was exposed to the constant current, rhythmical contractions began always on the cathodal side when the medusa was immersed in normal sea water, but that the contractions began on the anodal side in acidulated sea water. Likewise, it was shown that acids induce a phase of contraction, and alkalis a phase of relaxation. It was suggested that these results may throw some light on the supposed electrical nature of muscle contraction, and that they offer additional evidence toward the conclusion that the charge carried by the protoplasmic particles depends on certain definite chemical conditions of the surrounding medium.

WILLIAM TRELEASE,
Recording Secretary.

AMERICAN CHEMICAL SOCIETY.
NEW YORK SECTION.

AT the second meeting of the season held November 6, at the Chemists' Club, the following papers were presented:

Nitro-sulphuric Acid and Its Action on Organic Compounds, Part I.: C. W. VOLNEY.

Dr. Volney presented the results of both special experiment and long observation on the behavior of nitro-sulphuric acid in the production of nitro compounds and organic nitrates,

especially nitroglycerin and guncotton, and showed that the action of the sulphuric acid is not merely that of a dehydrating agent, to absorb the water formed by the reaction. It was held that the nitric acid is itself dehydrated and condensed, the action being represented by the equation

$$2HNO_3 + H_2SO_4 = O\begin{matrix} \diagup NO_2 \diagdown \\ \diagdown NO_2 \diagup \end{matrix}SO_4 + H_2O,$$

which would explain satisfactorily the formation of the organic nitrates. The author promised a continuation of this paper in which the reactions will be discussed in detail.

Meta-amino-benzonitril and Some of Its Derivatives: H. T. Beans.

A brief account of the previously published methods of obtaining *m*-amino-benzonitril was given, and a method for its preparation by reduction of the nitronitril with stannous chloride in hydrochloric acid was described. The acyl-, benzoyl-, urea-, thiourea-, oxal- and succinyl- derivatives were prepared and their properties and decompositions studied. The compound was also found to give addition and condensation products with chloral which were described.

The Proteolytic Cleavage-products of Gelatine: P. A. Levene.

The object of this work was to compare the composition of the intermediate digestion products of proteids. Special attention was paid to the percentage of glycocol in gelatine, gelatoses and gelatine peptone. It was found that gelatoses contained in their molecule more glycocol, while the peptone contained less glycocol, than gelatine. In harmony with this is the observation that in the early stages of digestion, of the final nitrogenous decomposition products only ammonia can be demonstrated, while on prolonged treatment with proteolytic enzymes glycocol appears in quantities predominating over other crystalline products of digestion. Among these, besides glycocol, were found leucin, glutamic acid and phenylalanin.

A Device for the Accurate Reading of Burettes: W. E. Chamberlain.

Dr. Chamberlain discussed briefly the avoidance of parallax in reading and of the adhesion of drops to the walls, in the use of burettes.

H. C. Sherman,
Secretary.

TORREY BOTANICAL CLUB.

At a meeting of the club held at the College of Pharmacy, November 10, 1903, at 8 P.M., the following program was presented:

Mrs. Cunningham, of California, a prominent organizer in that state of clubs for the preservation of wild flowers, was present and by request exhibited a large collection of water-color sketches of California wild flowers and spoke briefly of the best places and seasons for finding them.

The first regular paper was by Dr. Underwood on 'The Botanical Gardens of Jamaica.' He outlined the history and described the present condition of each of the four public gardens of Jamaica, illustrating his remarks with numerous photographs. The first garden established was at Bath in 1779. This is at the eastern end of the island, where the climate is hot and very humid. It was virtually abandoned many years ago, but a number of interesting trees are still standing. The location was not fully satisfactory, and in 1863 another garden was established at Castleton in the Wag Water Valley, twenty-five miles north of Kingston. This is now probably the finest and most interesting botanical garden in the West Indies. It contains a very notable collection of palms, said to include 180 species. In 1868 another garden was established at Cinchona on one of the spurs of the Blue Mountain range at an elevation of nearly 5,000 feet. It was intended to test the practicability of the growing of cinchona for its bark on a commercial scale, but many other trees and plants adapted to high altitudes in the tropics were planted, and for some years it was the headquarters for the botanical work of the island. Owing to its inaccessibility, still another garden was established in 1873 at the Hope plantation in the outskirts of Kingston on the south side of the island. This is now the headquarters for the botanical and agricultural departments of Jamaica, and

besides its features as a botanical garden proper it is used as a nursery for propagating economic plants for distribution to the planters of the island and as an agricultural experiment station for the investigation of various agricultural problems.

The second paper was by Dr. Howe, on 'The So-called Flowering of the Adirondack Lakes,' a phenomenon caused by the growth of one of the minute blue-green algæ, specimens of which were exhibited. The substance of this paper appeared in the October issue of *Torreya*.

Dr. Britton spoke of the recent discovery by Mrs. Goodrich, at Syracuse, of *Phacelia dubia*, a plant new to the New York state flora. This discovery extends the known range of the plant several hundred miles farther north.

On motion, the thanks of the club were voted to Mrs. Cunningham for her interesting exhibition of flower paintings.

F. S. EARLE,
Secretary.

THE SCIENCE CLUB OF THE UNIVERSITY OF WISCONSIN.

THE club held its first meeting of the academic year on October 5, President F. P. Turneaure in the chair. The paper of the evening was given by Professor Victor Goldschmidt, of Heidelberg University, on 'Recent Developments in Crystallography.' Professor Goldschmidt discussed his recent work on the etching figures formed on calcite crystals and on spheres of calcite when subjected to the dissolving action of acids.

VICTOR LENHER,
Secretary.

DISCUSSION AND CORRESPONDENCE.

THE CHEMISTRY OF SOILS AS RELATED TO CROP PRODUCTION.*

The following quotations will best define the scope of this bulletin of seventy-one pages, and the theses which it is intended to establish and maintain.

Page 7. "The investigations made by the Bureau of Soils during the last ten years have shown that the economic distribution of crops is dependent mainly upon the physical characters of soils, and upon climate."

Page 13. "Briefly stated, the results given in the following pages appear to show, contrary to opinions which have long been held, that there is no obvious relation between the chemical composition of a soil as determined by the methods of analysis used and the yield of crops; but that the chief factor determining the yield is the physical condition of the soil under suitable climatic conditions."

Page 63. "The exhaustive investigation of many types of soil by very accurate methods of analysis under many conditions of cultivation and cropping, in areas yielding large crops and in adjoining areas yielding small crops, has shown that there is no obvious relation between the amount of the several nutritive ingredients in the soil and in the yield of crops."

Page 64. "It appears farther that practically all soils contain sufficient plant food for good crop yield; that this supply will be indefinitely maintained, and that the actual yield of plants adapted to the soils depends mainly, under favorable climatic conditions, upon the cultural methods; a conclusion strictly in accord with the experience of good farm practice in all countries."

The bulletin contains extended tables showing the results of the analytical work, and at the end, a full description of the methods employed therein.

The above four paragraphs, taken respectively from the beginning and the latter part of the bulletin, summarize the conclusions to which, as it states, 'the Bureau of Soils has been forced.'

These conclusions are certainly startling, to say the least; and perhaps not the least remarkable is the concluding one, which hardly agrees with the impressions left upon the mind of most of those who have made themselves acquainted with the history of agriculture, and its past and present practice in the most advanced civilizations.

Were such statements to emanate from a private laboratory, on a mere personal responsibility, it would be likely to be passed

* Bureau of Soils Bulletin No. 22, 1903.

over and allowed to run its course. But when it emanates from the head of the Bureau of Soils in the United States Department of Agriculture, and is expressly and persistently given as the opinion of that bureau, it can not be thus passed over unchallenged.

The above quotation from page 7 of the bulletin practically prejudges, or begs, the main question at issue. To any one outside of the bureau the cogency of this statement is far from apparent, except in so far as it may mean what has long been known and recognized, and need not, therefore, have been shown anew by the bureau.

If we examine the experimental basis upon which all these assertions are made, we find it to be the assumption that the aqueous soil solution is the exclusive source through which plants derive their food; and the fact, assumed to be demonstrated by a newly devised method of analysis, that that solution is practically of the same composition in all soils, so far as the mainly important plant-food ingredients are concerned. Throughout the bulletin the determinations thus made are considered and mentioned as constituting an 'exhaustive investigation of many types of soils, by very accurate methods of analysis.'

It is not the intention of the present writer to question the accuracy of the analyses, such as they are. But it is notorious that there are a great many methods that may and have been used for the chemical analysis of soils, each susceptible of great analytical accuracy, but in many if not in most cases having no practical bearing upon the agricultural value of the soils analyzed. The method of ultimate silicate analysis is one; and it is generally conceded that the results so obtained have but a very remote bearing upon the practical value of a soil. The method of extraction with distilled water is another; it is the opposite extreme, and unlike the silicate analysis, can certainly not be considered 'exhaustive.'

Now the criterion usually applied to the relevancy of soil analyses is whether they will stand the test of agricultural practice. Judged by this test, both the ultimate analysis and that by distilled water are, equally, failures, according to Whitney's own testimony. But his conclusion is that since his method fails as a criterion of rich and poor soils, therefore the chemical composition of soils has no bearing upon crop production; and that, therefore, 'the chief factor determining the yield is the physical condition of the soil under suitable conditions.'

To this assertion 'non sequitur!' is the obvious first answer. But before discussing it, it seems proper to recall, as regards the personal standpoint of the present writer, that he was the first one to undertake systematic physical soil work in the United States, in the early sixties; and has steadily pursued it ever since, as his publications* show. He has always held, taught and written that the physical soil conditions are the first thing needful to be considered in the estimate of a soil's practical value, the chemical composition second; since faults in the latter can in most cases be much more readily remedied than faulty physical conditions. But that chemical composition is the chief determining factor of phytogeography in the humid region, and inferentially of crop production within the same, became his conviction in the prosecution of the agricultural survey of Mississippi; and hence he made it prominent in his work in that state. In the arid region, where moisture is the dominant factor, and soil composition much less varied, soil physics has received his chief attention. It can not, therefore, be truthfully said that the writer has not fully recognized the enormous importance of physical soil conditions, both in his teachings and his publications.

Eleven years ago it fell to his lot to controvert the hypothesis then put forth by Whitney, to the effect that fertilizers act, not by conveying nourishment to plants, but by modifying the physical texture of the soil.† The recent enunciation of the chief of the Bureau

* *Proc. A. A. A. S.*, 1872, 1873; *Amer. Jour. Sci.*, 1872, 1873, 1879; *Proc. Soc. Prom. Agr. Sci.*, 1882–1898; 'Wollny's Forsch.,' 1879–1896; *Centralblatt für Agriculturchemie*, 1886; *Agr. Sci.*, 1892; *Jour. Amer. Chem. Soc.*, 1894; U. S. Weather Bureau Bull. No. 3, 1892; *Ann. de la Sci. Agron.*, 1892; Calif. Agr. Expt. Sta. Reports and Bulletins, 1877–1903.

† *Agr. Sci.*, 1892, pp. 321, 566.

of Soils, while still maintaining the preferential claim for the physical properties of the soil, at least admits the importance of the functions of plant food; but claims that fertilization is unnecessary because the supply will be 'indefinitely maintained.' He in fact takes us back to the times of Jethro Tull and the Louis Weedon system of culture, which also presupposed the indefinite duration of productiveness; but signally failed to realize it when the test of even as much as twelve years came to be applied. How can Whitney reconcile this predicted indefinite productiveness with the actual facts well known to every farmer, good and bad, who has ever taken fresh land into cultivation, and when pricing it is perfectly aware that after a period ranging from three years, *e. g.*, on the long-leaf pine lands of Mississippi to thirty or more years in the black prairies, he must needs resort to fertilization if he wants a paying crop; while in the Yazoo clay lands and the alluvial soil of the Houma country, hardly a diminution of production has occurred even yet? If, indeed, the soil solution is of the same composition in all these lands, then the common-sense conclusion is, obviously, that if the soil solution is the sole vehicle of plant nourishment, it must be supplied more quickly and continuously in the 'rich' than in the 'poor' soils. Certainly, *considering that both rich and poor soils are represented in the entire gamut of physical texture,* it is impossible to conceive that such changes in texture as would be brought about by poor cultivation should not occur in both. Yet the rich soils—those shown by the despised chemical analysis with strong acids to contain abundance of plant food, continue to produce abundantly, while the poor lands 'give out.' Hence, admitting for argument's sake that the soil solutions are really of the same chemical composition, it is clearly not the physical texture alone, or chiefly, that can account for these differences.

Whitney states in this connection (p. 51) that I have 'called attention to an apparent exception to this rule (that production is sensibly proportionate to the water supply) in heavy adobe (heavy clay) and sandy lands in California, which bear equally good crops of wheat.' It happens that this 'exception' holds good throughout the somewhat extensive arid region of the United States; and my explanation is not only, or mainly, that the roots go deeper, but that in the arid region, sandy soils are as a rule quite as rich in plant food (again by chemical analysis of the rejected sort) as the clay soils. Hence the abundant and lasting production of the arid sandy lands (even drifting sands) when irrigated.

Whitney's argument that even the rich arid soils can not yield more than the maximum crops of the humid region can hardly be taken seriously.

It is a striking fact that in the entire bulletin only a single full soil analysis (*i. e.*, one made with strong acids) is quoted. There is a table giving the results of determinations of available plant food, determined by the official method, alongside of the distilled water extract; and it is apparent that the two differ widely. But there is no definite agreement among soil chemists as to the 'available' determinations, whether as to value or method; the matter is still in the tentative stage, and I wholly dissent from the 'official prescription.' The table in question proves nothing. But it would have been instructive, so long as Whitney wishes to disprove the value of soil analysis as usually made, to have at least some of the soil classes he adduces as proofs, analyzed by the usual methods; if only in order to show that these soil types—the Cecil clay, the Sassafras loam, Norfolk sand, etc., are really, as alleged by him, the same soils over the area assigned to them. How have these soils been identified in the mapping? We are informed (p. 8) that 'the classification of soils in the surveys made by this bureau is based mainly on physical differences, apparent to a trained observer.' It is apparent from the annual reports that the mineralogical and geological data which are elsewhere considered as essential to a definite characterization of a soil, and which certainly are to be counted among the physical characteristics, are in most cases wholly ignored. Instead, we have local names by the thousand, conveying no meaning whatever to those not acquainted with the localities; since nothing but a scantily inter-

preted physical analysis is ordinarily given. Even when the mineral composition of the soil is obvious, these meaningless local names are retained as against preexisting local or descriptive designations. Thus we have, *e. g.*, a 'Fresno sand' appearing also in the report on Orange and Monterey Counties, California —localities hundreds of miles apart. To the uninitiated only the physical analysis is offered as a mark of their identity by the trained observer. It seems a pity that that training should not have extended to calling that material a granitic sand, which would have rendered the designation intelligible all over the world, at the same time conveying important practical information in view of the well-known cultural characteristics and value of granitic soils. It is given out that these studies will be made later in the laboratory. But it may be seriously questioned whether it would not be better to cover less ground more thoroughly, and be content with less extended and hasty mapping. This superficial method of work naturally excites criticism, not only at home, but also abroad.*

Until some better proof of identity is shown we can not accept Whitney's conclusions based on the similarity of the soil solution with widely varying production on 'the same soil'; and his entire argument suffers seriously from the absence of any convincing proof that 'rich' soils do not supply plant food, even in aqueous solution, *more rapidly* than does 'poor' land.

But is the aqueous solution the only source of supply? Whitney rejects *in toto* the idea that anything but the carbonic acid secreted by the roots aids the solution of plant food; but his method of analysis practically ignores even this solvent, the use of which was suggested and actually carried out by David Dale Owen, and tried by myself, in the early fifties. I found it unsatisfactory and abandoned it; but it would seem to have been incumbent upon Whitney and his coworkers to introduce this inevitable agency into their soil extractions, if it was intended to represent natural conditions. This is a fundamental, not to say fatal, defect.

* *Biedermann's Centralblatt*, February, 1903, p. 143.

But there is still a wide difference of opinion in this matter of the acid root secretions, and the investigators quoted by Whitney have by no means settled the matter. Among others, Kossowitch,* when observing the fact that calcic bicarbonate leached from his vegetation pots, failed to establish the absence of other organic acids from the solution. The old etching experiments have not, to my mind, lost their force; and in my experience I find it difficult to overcome the evidence of litmus paper reproducing a faithful image of citrus roots (in the soil) filled with a .83 per cent. solution of citric acid.† If the *paper* can take up the acid from the root surface, surely the much stronger capillary action of the soil can do so, according to Cameron's experiment quoted on page 54.‡ But if so, *Whitney's entire argument based on watery soil solutions falls to the ground.*

Not the least remarkable part of the bulletin is that in which Whitney discusses the use and action of fertilizers. He does admit that 'there is no question that in certain cases, and in many cases, the application of commercial fertilizers is beneficial to the crop.' But he calmly brushes aside, as so many cobwebs, the enormously cumulative evidence of all the practical experience of three quarters of a century in the use of commercial fertilizers, as well as the carefully guarded culture experiments made during that time by numerous scientific workers; and announces the truism that climatic and seasonal conditions *may* neutralize the beneficial effects of any and all fertilizers used. This has been long and often said, experienced and foreseen; every one

* 'Ann. de la Sc. Agron.,' 2 ser., 1, 220, 1903.

† Report Calif. Expt. Sta. for 1895–6 and 1896–7, p. 181.

‡ "When a porous cell having deposited in it a semipermeable membrane through which water can pass freely, but through which salts and certain organic substances like sugar can not pass readily, is buried in a soil short of saturation, but yet in fair condition for plant growth, the soil will draw water from the cell against a calculated osmotic pressure in the cell of 36 atmospheres, or about 500 pounds per square inch."

knows that deficiency of moisture or heat, or imperfect cultivation, as well as the improper manner of application of fertilizers, may render them wholly ineffective. We have also long known that soluble fertilizers soon become insoluble (but not necessarily unavailable) in the soil, in a manner fairly well understood, and that hence they can not long influence the watery soil solution to which Whitney pins his faith. But since the same conditions influence the unfertilized soils to even a greater degree, manifestly because of the slower and less vigorous development of the plants, it is not easy to see what special corroboration Whitney's hypothesis can derive therefrom. He calmly discards, as having been made under 'abnormal conditions,' the elaborate and conclusive experiments made by the best observers in pot culture, in which the physical factors were so controlled as to eliminate them from the problem of the action of special fertilizers; and we are told that 'very little effect is obtained in field culture in attempts to increase the value of crops showing inferior growth, by the application of fertilizers.' A trip through the malodorous turnip fields of the Low Countries or of Switzerland in autumn would convince even the Bureau that the thrifty inhabitants know that when a fertilizer is made to reach the feeding roots its action is invariably most strikingly beneficial. That a top dressing of insoluble fertilizers on a growing crop can do but little good needs no discussion; and it is but too true that a great deal of the fertilizers used in the arid region remains wholly ineffective for a long time because of the deep range of the feeding roots and the shallow application of insoluble fertilizers.

In the classic water-culture experiments of Birner and Lucanus, quoted in the bulletin (p. 15), the well water was supplied continuously and in indefinite amounts. It is thus no wonder that the results were so good, for at no time was there a lack of plant food supply, nor would such changes as would injuriously affect the growth occur. But for these frequent renewals of the water the result would doubtless have been very different, if only as a consequence of changes in the *reaction* of the solution. It is singular that this important point is not even casually mentioned in the bulletin with respect to the soil solutions. The deleterious effects of soil acidity upon most culture plants, long known in general, has been well and thoroughly investigated by H. J. Wheeler.* Yet neither in the tables nor in the text of this bulletin do we find any evidence that this point has had any attention with respect to its possible bearings on the differences in production on what are held by the bureau to be identical soil areas. We are not informed whether the large amounts of lime present in some of these solutions were sulphate or carbonate; yet the importance of this difference is enormous, as is well shown by the contrast between the natural vegetation as well as the cultural value of gypseous as against limestone lands, which are everywhere among the most productive. An excellent illustration of what this omission may mean exists on the Gulf Coast of Mississippi, where (as I have shown in the 'Report on Cotton Culture,' Tenth Census, Vol. 5, p. 69) the soil of the infertile 'sand hammocks' differs from the highly and lastingly productive soil of the 'shell hammocks' almost alone in the proportion of lime (calcic carbonate) and phosphoric acid present, and in having an acid reaction; the percentages of plant food being very low in both, and both equally of great depth. This observation, together with others, led me very early (1860) to the conclusion that mere *percentages* of plant food were not in all cases proper criteria of soil fertility; and also to the enunciation of the statement which I have repeated many times in both my teaching and my publications, to wit: 'While all fresh soils of high plant food percentages are highly productive under all but very extreme physical conditions, the reverse is by no means true; since soils with low percentages may be highly productive if the relative proportions of the several ingredients be good, and the soil mass deep.' I have for some years carried on an investigation to determine the limits of dilution within which plants will do equally well in soils of high fertility (and plant food percentages) when these are diluted

* Reports of the Rhode Island Expt. Sta.

with quartz sand. While not yet completed, this investigation has already shown that a rich adobe (clay) soil, as well as an equally rich sandy soil, diluted to an extent of four to one, shows equally good growth, but that when in these soils the dilution reaches five to one, development is quite slow, and in a short season would mean a crop failure. The moisture content was in all these cases maintained at one half the maximum water capacity of each diluted soil. Photographs show clearly that here the roots made up by their extension for the lack of concentration of the food supply; but at the dilution of one to five they were unable to make up that deficiency, at least within a reasonable time, although the same total *amount* of food ingredients was always present in the increased bulk. Other things being equal, it is the *proportion*, then, between the several soil ingredients, quite as much as the absolute quantity at hand, that determines production. Incidentally, this experiment shows the wide variation of physical composition (from a soil containing 35 per cent. of colloidal clay to one with only 8.75 per cent., and in the sandy soil from 7.6 per cent. to 1.9 per cent.) within which plants will do equally well, provided the plant food ingredients are rightly proportioned; and provided also that a proportionally large soil mass is available to each plant.

In the foregoing discussion, only the salient points of the bulletin in question have been taken up, and their most obvious weaknesses briefly considered. To do more would involve the writing of a paper as long as the bulletin itself; and it is to be hoped that the matter will be taken up by others, also. Thus, for instance, the Rothamstead Station might have something to say regarding the singular interpretation here put upon the splendid work of Lawes and Gilbert.

In conclusion, it seems to the writer that the verdict upon the main theses put forward so confidently in this paper must be an emphatic 'Not proven!'

E. W. Hilgard.

Berkeley, California,
November 11, 1903.

ABSORBED GASES AND VULCANISM.

To the Editor of Science: The descriptions of the spine of Mont Pelé by Hovey and Heilprin remind me of the phenomenon I observed some ten years ago, when my mind was on the subject of the part which the original absorbed gases play in vulcanism, as discussed in my paper in the *Bulletin of the Geol. Soc. Am.*, March 3, 1894. I had a bottle of Werner's grape milk packed in the place of the tin of an ice cream freezer, the same having served its purpose, in order to cool it. I presume any other carbonated beverage would work similarly. Though chilled well below 0° C. the beverage remained clear and unfrozen, as long as it was corked, but upon removing the cork the gas began to escape and freezing to set in rapidly. Sometimes nearly the whole contents of the bottle would freeze. Upon one occasion, however, I remember seeing a 'volcanic plug' of frozen matter forced out in a round cylinder from the neck.

I am inclined to think that there may be a very close analogy with the Mont Pelé spine. I think it would not be very difficult to reproduce this phenomenon, though I can not tell the exact temperature at which it occurred.

Alfred C. Lane.

SHORTER ARTICLES.

THE HEREDITY OF 'ANGORA' COAT IN MAMMALS.

That Mendel's law is a fundamental principle of heredity becomes daily clearer as new illustrations of its workings come to light, either through a reexamination of the older observations on heredity or through the performance of new experiments. One of these new illustrations it is the purpose of this note briefly to describe.

The writer has already pointed out, in the columns of Science, two pairs of alternative, or Mendelian, characters pertaining to the hairy coat of guinea-pigs. (1) A pigmented coat of any sort is dominant over an unpigmented, or albino, coat. Accordingly when a pure-bred pigmented guinea-pig is mated to an albino, the young are invariably pigmented. (2) The rough, or 'rosetted,' condition of coat found in so-called Abyssinian and Peru-

vian guinea-pigs is dominant over the normal, or smooth-coated, condition.

To these two pairs of Mendelian characters we may now add a third: 'Angora,' or long coat, is recessive with respect to the normal short coat. This fact was first discovered accidentally when a number of long-haired young were obtained by inbreeding a stock of short-haired guinea-pigs supposedly pure. A parallel result was obtained in the case of rabbits. Two rabbits, brother and sister, whose ancestors for at least two generations were known to have been short-haired, produced, in a litter of six young, two long-haired, or 'Angora,' individuals.

As a result of experiments subsequently made, it may now be said that, in the case of guinea-pigs and rabbits (and probably in other mammals also):

(1) Two long-haired animals of whatever ancestry produce only long-haired young; (2) a short-haired animal of pure stock, mated to a long-haired animal, produces offspring all short-haired; (3) a short-haired animal, one of whose parents was long-haired, when mated to a long-haired animal produces offspring, some short-haired, others long-haired, the two sorts occurring in approximately equal numbers; (4) two hybrid short-haired animals (like the one described under 3) when mated to each other produce long-haired and short-haired offspring approximately in the ratio, 1:3. These various facts agree in showing that short coat is 'dominant' in heredity over long or Angora coat.

The writer recalls seeing in the daily press some months ago a brief despatch (which unfortunately he did not preserve) recording the exportation (to Hagenbeck, he thinks) of the 'last of the Oregon Wonder horses,' which had mane and tail fourteen feet long. A short account, which was given, of the ancestry of this abnormally long-haired horse suggested to the writer that the long-haired character was in this case, as in rabbits and guinea-pigs, inherited as a recessive, and that the so-called 'last' of the long-haired horses need not have been such had the owner been familiar with the scientific principles of breeding. If any reader of SCIENCE can give further information about these long-haired Oregon horses, the writer would be very grateful to receive it. It seems to him extremely probable that in mammals in general an abnormally long coat behaves as a recessive character in heredity, when brought by cross-breeding into competition with the normal coat character. If so, this fact makes clear some matters which have been hitherto obscure and which have received a different but hardly satisfactory explanation. Thus Darwin attributes to the direct influence of the climate the long-haired coat character of the goats, shepherd-dogs and cats of Angora, and states on authority that the Karakool breed of sheep lose their peculiar fine, curled fleece when removed from their native canton near Bokhara. It is clear that a long-haired breed of animals would apparently lose that character completely and immediately, if allowed to cross with other breeds, as would likely be the case upon removal to a new locality. Yet this loss would occur irrespective of any climatic influence.

It is hoped that the facts here communicated may prove of some value to breeders of sheep and goats, such as are kept primarily for the fleece, as well as to breeders of pet stock. May we not work more intelligently for the improvement of our flocks, knowing the conditions under which the long-haired coat is transmitted?

W. E. CASTLE.
ZOOLOGICAL LABORATORY,
HARVARD UNIVERSITY,
November 23, 1903.

CONCERNING MOSQUITO MIGRATIONS.

IN the pages of SCIENCE I have recorded from time to time the results of my observations upon the habits of the ring-legged salt marsh mosquito, *Culex sollicitans,* and have expressed my conviction that it was a migratory form; limited in its breeding areas, but widely distributed and dominant for long distances away from them. In my study of the problem as it exists in New Jersey, this migration question is of the utmost importance, since local work can never be entirely effective if the mosquito supply comes from a place beyond the range of local jurisdiction. It is

absolutely necessary that the point should be positively determined, since no comprehensive plan can be formulated without considering how such migratory forms should be dealt with and what authority should have control.

During the season of 1902 I worked out the life cycle of *Culex sollicitans,* and satisfied myself that it was a true migrant. I found associated with it three other species, breeding under similar conditions, whose status I could not altogether fix. These were *C. nigritulus, C. tæniorhynchus* and one which I made certain was different from described species; but which was then determined by authorities to be a form of *C. sylvestris.* Further study proved my contention as to this species to be correct, and it has been recently named *C. cantator* by Mr. Coquillett. All these breed on the salt marshes and, as a rule, on the marshes only, though the water may be salt or fresh. *C. nigritulus* I have never found far away from the edge of the marsh in the adult condition. *C. tæniorhynchus* never flies very far nor in any considerable numbers. *C. cantator* and *sollicitans* have equal powers of flight and either may be dominant on the marsh at a given period, or both may be equally abundant.

Investigations made in 1903 indicate that *C. cantator* gets an earlier start and may fly long before *sollicitans* appears in large broods. Further, it is more northern in its range and, while it equals or exceeds *sollicitans* on the Raritan and Newark marshes, it is hardly noticeable from Barnegat Bay southward.

C. cantator is a stout, hairy yellowish-brown mosquito with obscurely banded legs; very different from the bright contrasts found in *sollicitans.*

To determine the question of migration and breeding areas positively, one observer was located at Cape May from the beginning of June to the end of September, with instructions to watch *C. sollicitans* day by day and, if it bred anywhere on the peninsula, to find the breeding places. Mr. Henry L. Viereck, who made these observations, reports positively that, while the adult occurred throughout the territory assigned to him, it bred only on the salt marshes or at their edge. Furthermore, he observed directly that, shortly after a brood emerged on the marshes, there would come a sudden decrease in the numbers of adults and a corresponding increase at points inland. In all his collectings not a *sollicitans* larva was found in the fresh-water swamp area of the peninsula!

Six other collectors were regularly in the field during the breeding season—not intermittently, but daily, and the result was that thirty-three species of mosquitoes were collected. And of these, thirty-one were actually bred from larvæ during the summer! Much of this collecting was done in the regions dominated by *sollicitans* and *cantator,* yet neither was found at any time in the larval stage away from the salt marshes or their edge.

Personally I watched the emergence of an early brood of *cantator* on the Newark meadows before there was a mosquito in the city, and when the surroundings on the hillside had been thoroughly surveyed and no similar larvæ discovered. These adults were watched from day to day as they spread inland until the city swarmed with them and they invaded the surrounding country in every direction. *C. sollicitans* did not at any time in 1903 dominate the Newark meadows as it did in 1902, and *cantator* was not generally recognized at first as a salt-marsh species.

At the mouth of the Raritan River the marshes near Perth and South Amboy were kept under close observation throughout June, and toward the end of that month conditions favored the development of an immense brood of mixed *sollicitans, cantator* and *tæniorhynchus.* Meanwhile the course of the Raritan had been followed up to Bound Brook and the territory around New Brunswick and Metuchen had been explored for miles without finding similar larvæ. July 1, the Amboy meadows were alive with adults, and during the night of July 2 to 3 the advance guard reached New Brunswick. The main body came during the two or three next following nights and extended up the Raritan valley. Another body followed a depression toward Metuchen and concentrated on Dunellen, where no chance for breeding such mosquito hordes exists.

Culex sollicitans is always the summer pest in the Jersey Pines—even where there is no water of any kind, and yet I had never been able to find in the swamps any larvæ. Mr. J. Turner Brakeley, who had made observations for me in previous years, began, early in this year, a systematic search in all the breeding areas near his cranberry bogs at Lahaway, over twenty miles in a direct line from the shore and nearly forty miles from the Mullica River marshes. He worked out the early life history of *Culex canadensis*, the winter history of *Culex melanurus* and discovered an entirely new species, *Culex aurifer;* but he failed absolutely to find any larvæ of *Culex sollicitans*. Nor did he see even the adults of that species until late in July; up to which time the pines were practically mosquito-free.

Dr. Julius Nelson, biologist to the New Jersey experiment stations, was engaged in oyster investigations on the marshes near Tuckerton during July and, incidentally, kept an eye on mosquito conditions for my benefit. Up to about July 12 the marshes were quite free from both adults and larvæ; but on that date an unusually high tide covered them and, on the 13th, minute wrigglers of *C. sollicitans* were in every water-filled hole. July 21 the males emerged in clouds and only pupæ were in the water. Females were out on the 22d but would not bite. On the evening of the 23d it was warm, with only a light breeze, and just at dusk a peculiar humming noise seemed to fill the air. The source of this was located at a height of between sixteen and twenty feet above the marsh, where clouds of mosquitoes hovered in their marriage flight. On the 24th few males were seen; but the females were now in droves and bloodthirsty as butchers. Then came cold north and west winds that kept the insects low down among the grass. On the 28th the wind veered to the south and continued so all that night and all day on the 29th. On the morning of the 29th the number of mosquitoes on the marsh had diminished materially, and this was yet more decidedly marked on the morning of the 30th when they were quite bearable. But in the woods, where on the 20th there had been few mosquitoes, they were worse on the 31st, when Dr. Nelson came out to Tuckerton, than they were on the marsh itself.

Dr. Nelson gave me this record on his return to New Brunswick and next morning came a letter from Mr. Brakeley who in previous communications had uniformly reported 'no salts.' Now, however, he sent in great detail, accompanied by specimens as vouchers, a report of how, during the night of July 28–29, *Culex sollicitans* had arrived in swarms and how, during the two nights following, the entire pine region for several miles round about had become infested. Of the testimony gathered by Mr. Brakeley one item is especially important—a farmer driving out for a doctor early in the evening through a mosquito-free wood and coming back late to find it swarming with bloodthirsty specimens.

Lahaway is exactly in the line of a flight on a south wind from the Mullica River, the distance to be covered is between thirty and forty miles, and the two series of entirely independent observations are altogether too closely congruent to be set aside as accidental and unconnected. The known antecedent conditions and the completeness of the observations leave only one possible explanation. The mosquitoes that left the marshes on the evening of July 28 reached the pines, over thirty miles north, before daylight next morning. What I have given here are examples of the kind of evidence that I have accumulated. It is not a series of isolated observations, but a daily record; made not by one man, but by a number working independently. Nor was the record confined to one period; it extended throughout the summer, beginning with the first larvæ found on the marshes in March and ending only with the last stragglers late in October.

It is of some importance to note that local conditions determine the development of these salt-marsh mosquitoes. All the species (save possibly *nigritulus*) lay their eggs in the mud of the marsh—never in water. Whenever these eggs become covered with water they hatch, and if there is water enough a brood develops. It may rain at Cape May and not at Atlantic City, and there has been a fall of

two inches or more at Newark, when not a drop fell on the Amboy marshes. There is no such thing, therefore, as a uniform breeding throughout the state, though identical conditions, like a general storm, may bring out broods from a number of localities at one time.

Nor is it impossible that, exceptionally, larvæ of any of the salt-marsh forms may be found away from their normal breeding areas. Personally I have never found *sollicitans* in that way; nor have any of my collectors so found it. But larvæ of *cantator* have been found on one occasion half a mile back, though not much above the general marsh level. But these are accidentals, due probably to the desire of a single gravid and perhaps injured female to place her supply of eggs.

John B. Smith.

Rutgers College, New Brunswick, N. J.,
November 25, 1903.

THE CONGRESS OF ARTS AND SCIENCE OF THE ST. LOUIS EXPOSITION.

As has already been stated here, the scientific committee of the St. Louis Exposition, consisting of Dr. Simon Newcomb, of Washington, Professor Hugo Münsterberg, of Harvard, and Professor Albion W. Small, of Chicago, visited Europe during the summer months to present personal invitations to European men of science to take part in the congress. The field was divided so that Dr. Newcomb gave his time to France and England, Professor Münsterberg to Germany and Switzerland and Professor Small to Austria and Russia, and in conjunction with Dr. Newcomb, to England. The committee returned to this country the latter part of September and reported to the Director of Congresses and the Administrative Board in New York, October 13. One hundred and fifteen acceptances have been received, as follows:

DEPARTMENT 1. PHILOSOPHY.

Metaphysics: Bergson, M. Henri, Membre de l'Institut, Paris.

Philosophy of Religion: Pfleiderer, Prof. Otto, The University, Berlin.

Logic: Riehl, Prof. Alois, The University, Halle. Windelband, Prof. Wilhelm, The University, Heidelberg.

Methodology: Ostwald, Prof. Wilhelm, The University, Leipzig. Erdmann, Prof. Benno, The University, Bonn.

Ethics: Sorley, Prof. W. R., The University, Cambridge, Eng.

Philosophy of Law: Binding, Prof. Karl, The University, Leipzig.

Esthetics: Lipps, Prof. Theodor, The University, Munich. Dessoir, Prof. Max, The University, Berlin.

DEPARTMENT 2. MATHEMATICS.

Geometry: Darboux, M. G., Membre de l'Institut, Paris.

Applied Mathematics: Boltzmann, Prof. Ludwig, Leipzig. Poincaré, M. H., Membre de l'Institut, Professor à la Sorbonne, Paris.

DEPARTMENT 3. POLITICS.

History of Asia: Cordier, M. Henri, Paris. Vámbéry, Prof. Armin, The University, Buda-Pest.

History of Greece and Rome: Pais, Signor Ettore, Musée Archeologique, Naples. Mahaffy, Prof. J. P., The University, Dublin.

Medieval History of Europe: Lamprecht, Prof. Karl, The University, Leipzig.

Modern History of Europe: Rambaud, M. A. N., Membre de l'Institut, Paris. Bury, J. B., Cambridge.

DEPARTMENT 4. LAW.

History of Roman Law: Zitelmann, Prof. Ernst, The University, Bonn.

DEPARTMENT 5. ECONOMICS.

History of Economic Institutions: Schmoller, Prof. Gustav, The University, Berlin.

DEPARTMENT 6. LANGUAGES.

Comparative Language: Brugmann, Prof. Friedrich Karl, The University, Leipzig. Paul, Prof. Hermann, The University, Munich.

Semitic Languages: Delitzsch, Professor Friedrich, The University, Berlin.

Indo-Iranian Language: Lévi, Prof Sylvain, Collège de France, Paris. Macdonnell, Prof. Arthur A., The University, Oxford.

Latin: Sonnenschein, Prof. E. A., The University, Birmingham.

English: Napier, Prof. Arthur Sampson, The University, Oxford.

Germanic: Sievers, Prof. Eduard, The University, Leipzig. Kluge, Prof. Friedrich, The University, Freiburg.

DEPARTMENT 7. LITERATURE.

Classical Literature: Jebb, Prof. Sir Richard C., The University, Cambridge, England.

Romantic Literature: Rajna, Prof. Pio, Florence.

Germanic Literature: Muncker, Prof. Franz, The University, Munich.

English Literature: Dowden, Prof. Edward, The University, Dublin.

Belles-Lettres: Brunetière, Marie-Ferdinand, Membre de l'Institut, Paris.

DEPARTMENT 8. EDUCATION.

History of Education and Educational Theory: Ziegler, Prof. Theobald, The University, Strassburg.

DEPARTMENT 9. ART.

Classical Archeology: Furthwängler, Prof. Adolf, The University, Munich.

History of Modern Architecture: Enlart M. Camille, Professor Écoles des Beaux Arts, Paris.

History of Modern Painting and Sculpture: Muther, Prof. Richard, The University, Breslau. Michel, M. André, Conservateur au Louvre, Paris.

DEPARTMENT 10. RELIGION.

Buddhism and Brahminism: Oldenberg, Prof. Hermann, The University, Kiel.

Mohammedanism: Ignácz, Prof. Goldziher, The University, Buda-Pest.

Old Testament: Smith, Rev. Prof. G. A., Glasgow, Scotland. Budde, Prof. Karl, The University, Marburg.

History of the Christian Church: Harnack, Prof. Adolf, The University, Berlin.

DEPARTMENT 11. PHYSICS.

Physics of Ether: Dewar, Prof. James, F.R.S., Royal Institution, London.

Physics of the Electron: Becquerel, M. Henri, Membre de l'Institut, Paris.

DEPARTMENT 12. CHEMISTRY.

Inorganic Chemistry: Mendeleef, Dmitry Iwanowitch, St. Petersburg.

Organic Chemistry: Fittig, Prof. Rudolf, The University, Strassburg.

Physical Chemistry: van't Hoff, Jakob Heinrich, Berlin.

Physiological Chemistry: Kossel, Prof. Albrecht, The University, Heidelberg.

DEPARTMENT 13. ASTRONOMY.

Astronomy: Backlund, Herr Otto, Director der Sternwarte, Pulkowa, Russia. Turner, Prof. H. H., F.R.S., Oxford.

Astro-Physics: Kapteyn, Prof. J. C., Groningen, Holland.

DEPARTMENT 14. SCIENCES OF THE EARTH.

Geology: Geikie, Sir Archibald, K.C.B., F.R.S., London.

Geo-Physics: Wiechert, Prof. Emil, Director Geo-Physikalischen Institut, Göttingen.

Geography: Mill, Dr. H. R., Librarian Royal Geographical Society, London. Gerland, Prof. Georg, The University, Strassburg.

Paleontology: Woodward, A. Smith, British Museum, London.

DEPARTMENT 15. PHYLOGENETIC BIOLOGY.

Plant Morphology: Bower, F. O., Glasgow. Goebel, Prof. K. F., The University, Munich.

Plant Physiology: Bonnier, Prof. Gaston, Paris.

Ecology: Flahault, Prof. Charles, The University, Montpelier. Drude, Prof. Oskar, Technische Hochschule, Dresden. Nuttall, G. H. F., Cambridge.

Animal Morphology: Girard, M. A. M., Membre de l'Institut, Paris.

Embryology: Hertwig, Oskar, The University, Berlin.

Comparative Anatomy: Delage, M. Yves, Membre de l'Institut, Paris. Fürbringer, Prof. Max, Heidelberg.

Human Anatomy: Waldeyer, Prof. Wilhelm, The University, Berlin.

Physiology: Engelmann, Prof. Theodor Wilhelm, Berlin.

Neurology: Erb, Prof. Wilhelm, The University, Heidelberg.

Pathology: Marchand, Felix, The University, Leipzig. Orth, Johannes, The University, Berlin.

Physical Anthropology: Manouvrier, M. L. Dodeur, Paris.

DEPARTMENT 16. PSYCHOLOGY.

Experimental Psychology: Ebbinghaus, Prof. Hermann, The University, Breslau.

Comparative and Genetic Psychology: Morgan, C. Lloyd, Univ. College, Bristol, Eng.

Abnormal Psychology: Janet, M. Pierre, Professor à la Sorbonne, Paris.

DEPARTMENT 17. SOCIOLOGY.

Ethnology: Steinen, Karl von den, The University, Berlin. Haddon, A. C., Christ's College, Cambridge.

Social Structure: Tönnies, Ferdinand, The University, Kiel. Ratzenhofer, Prof., Vienna.

Social Psychology: Simmel, Georg, Berlin.

DEPARTMENT 18. MEDICAL SCIENCE.

Internal Medicine: Allbutt, T. Clifford, Cambridge.

Gynecology: Richelot, Paris.

Otology and Laryngology: Seamon, Sir Felix, M.D., London.

Therapeutics: Brunton, Sir Lauder, K.C.B., F.R.S., London.

Tropical Medicine: Ross, Major F. W., The University College, Liverpool.

Pediatrics: Escherisch, Prof. Theodor, Vienna.

DEPARTMENT 19. TECHNOLOGY.

Mechanical Engineering: Riedler, A., Königliche Technische Hochschule, Berlin. Unwin, Prof. W. C., Central Technical College, London.

Chemical Technology: Witt, Otto N., Charlottenberg Polytechnic Institute, Berlin.

Agriculture: Lindet, Prof. Charles, Institute National Agronomique, Paris.

DEPARTMENT 20. PRACTICAL ECONOMICS.

Transportation: Philippovich, Eugen von, The University, Vienna.

Commerce and Exchange: Stieda, Wilhelm, Leipzig.

Money and Banking, Credit and Credit System: Lévy, Prof. Raphael Georges, Paris.

Industrial Organization: Conrad, Johannes-Ernst, The University, Halle.

DEPARTMENT 21. PRACTICAL POLITICS.

Diplomacy: Casimir-Perier, Ex-President.

National Administration: Bryce, Rt. Hon. James, 54 Portland Place, London.

Municipal Administration: Nerinck, A., University of Louvain.

DEPARTMENT 22. JURISPRUDENCE.

International Law: Zorn Philipp, The University, Bonn. Baron d'Estournelles de Constant, Paris.

Constitutional Law: Jellineck, Prof. Georg, The University, Heidelberg.

Criminal Law: Listz, Prof. Franz von, The University, Berlin. Wach, Prof. Adolf, The University, Leipzig.

Private Law: von Bar, Ludwig, Göttingen. Hilty, Prof. Karl, Berne.

DEPARTMENT 23. PRACTICAL SOCIAL SCIENCES.

The Rural Community: Weber, Prof. Max, The University, Heidelberg.

The Urban Community: Wuarin, Prof. Louis, The University, Geneva.

The Industrial Group: Sombart, Prof. Werner, The University, Breslau.

The Dependent Group: Münsterberg, E., Berlin.

The Criminal Group: Lombroso, Prof. Cesare, The University of Turin, Italy.

DEPARTMENT 24. PRACTICAL EDUCATION.

The School: Sadler, Prof. M. E., London.

The University: Ziegler, Prof. Theobald, The University, Strassburg.

The Library: Axon, Ernest, Assistant Librarian, Ref. Library, Manchester.

DEPARTMENT 25. PRACTICAL RELIGION.

Influence of Religion on Civilization: Black, Hugh, Edinburgh.

THE AMERICAN SOCIETY OF NATURALISTS.

THE twenty-second annual meeting of the American Society of Naturalists will be held at St. Louis on December 29 and 30, in affiliation with the American Association for the Advancement of Science, under the presidency of Professor William Trelease, of the Missouri Botanical Garden. Headquarters will be at the Planters Hotel and the meetings will be held at the Central High School. The annual discussion will take place on the afternoon of December 30, on 'What academic degrees should be given for scientific work?' in which a number of prominent educators and naturalists will take part. The public lecture by President David Starr Jordan, of Stanford University, on 'The Resources of our Seas,' will be on Tuesday evening in the auditorium of the Central High School. The annual dinner and the president's address will be given on Wednesday evening, December 30, at seven o'clock at the Mercantile Club (7th and Locust Sts.). A business meeting for the election of officers will he held at 6:45. The societies affiliated with the American Society of Naturalists which will meet at St. Louis are The Zoologists of the Central States, The Botanists of the Central States, The American Psychological Association, The American Society of Anthropologists. The general Secretary is Professor G. Ross Harrison, The Johns Hopkins University, to whom communications should be addressed.

SCIENTIFIC NOTES AND NEWS.

THE following is the list of council and officers of the Royal Society nominated by

the council for election by the society at the next anniversary: President, Sir William Huggins, K.C.B., O.M., D.C.L., LL.D.; treasurer, Alfred Bray Kempe, M.A.; secretaries, Professor Joseph Larmor, D.Sc., D.C.L., LL.D., Sir Archibald Geikie, Kt., D.C.L., Sc.D., LL.D.; foreign secretary, Francis Darwin, M.A., M.B. Other members of the council—George Albert Boulenger, F.Z.S., Professor John Rose Bradford, M.D., D.Sc., Professor Hugh Longbourne Callendar, LL.D., Frank Watson Dyson, M.A., Professor Harold Baily Dixon, M.A., Sir Michael Foster, K.C.B., D.C.L., Professor Percy Faraday Frankland, Ph.D., Sir Robert Giffen, K.C.B., LL.D., Professor William Dobinson Halliburton, M.D., F.R.C.P., Ernest William Hobson, Sc.D., Professor John Wesley Judd, C.B., LL.D., Professor George Downing Liveing, M.A., Professor Augustus Edward Hough Love, M.A., Adam Sedgwick, M.A., William Napier, Shaw, Sc.D., Captain Thomas Henry Tizard, R. N., C.B.

PROFESSOR JOHN U. NEF, head of the Department of Chemistry of the University of Chicago, has been elected a member of the Royal Society of Science at Upsala, Sweden.

PROFESSOR E. J. MAREY, of Paris, and Professor Camillo Golgi, of Padua, have been elected foreign corresponding members of the Vienna Academy of Sciences.

THE Denny gold medal of the British Institute of Marine Engineers has been presented to Mr. C. W. Barnes for his paper on ship electric lighting.

DR. FRANCIS RAMALEY, of the Department of Biology at the University of Colorado, at Boulder, has obtained leave of absence and will sail from San Francisco on December 22 for Japan. He will visit various botanical centers in the far east for purposes of study and for securing collections. During his absence the department will be in charge of Mr. Chancey Juday, M.A. (Wisconsin).

DR. MAXIMILIAN HERZOG, professor of pathology and bacteriology in the Chicago Polyclinic, has been appointed pathologist in the Bureau of the Government Laboratory, Manila, and will sail from San Francisco about December 30.

MR. DE WINTON has resigned the acting superintendency of the Gardens of the London Zoological Society.

SIR JOHN GUNN delivered the presidential address before the British Institute of Marine Engineers on November 23.

THE New York Alumni Club of the University of Wisconsin will entertain President Charles R. Van Hise at dinner at the Murray Hill Hotel.

PROFESSOR DICEY, of Oxford, delivered the Sidgwick Memorial Lecture at Newnham College, Cambridge, on Saturday, November 21. His subject was 'The Relation of Law and Opinion as illustrated by the History of the Combination Laws during the Nineteenth Century.'

MR. CLOUDSLEY RUTTER, of the U. S. Bureau of Fisheries, died on November 28, at Oakland City, Indiana, at the age of 36, after a short illness from erysipelas. Mr. Rutter was a graduate of the Indiana State Normal School and of Stanford University. He was a young man of unusual ability and energy, and had made very important studies of the salmon of our Pacific Coast, on which subject he was a recognized authority.

DR. CYRUS EDSON, at one time health commissioner of New York City, died on December 2, at the age of forty-six.

PROFESSOR HEINRICH MOEHL, director of the Meteorological Institute at Cassel, died on October 14.

DR. GARY DE HOUGH's collection of flies, especially Muscidæ (10,000 specimens), has been purchased for the Zoological Museum of the University of Chicago.

A SPECIAL fund of $10,000 is being collected by the New York Botanical Garden for the purchase of plants, specimens and books and for defraying the expenses of botanical exploration in the West Indies, Central America and the Philippine Archipelago. The sum of $8,781 had been contributed on December 1.

THERE will be a meeting in the rooms of the Board of Trade and Transportation, New

York City, to consider the question of the dissemination of mosquitoes. Governor Murphy, of New Jersey, has been invited to preside, and addresses are expected from Dr. L. O. Howard and others.

It is said that a project for the establishment of a Behring Institute, after the model of the Pasteur Institute in Paris, is under consideration by the German Government. The primary objects of the new institute are to be the furtherance of research in the domain of serum therapy and the accurate preparation of serums of all kinds.

Nature, for November 26, gives the first place to the following note.

A rumor has reached us that at the annual meeting of the Royal Society on Monday next an attempt is to be made by a certain section of the fellows to upset the selection of officers made last week by the council. It appears that the physiologists are under the belief that they have acquired a prescriptive right to hold one of the two secretaryships. It is true that for upwards of forty years they have so held it, but the group of natural sciences includes more than physiology or even biology, and the council, in the exercise of its discretion, has thought that it was high time that one of the other sciences should be represented in this secretaryship. We are further informed that a copy of a letter is being circulated which appears to convey an invitation from the president and council to a certain physiologist to accept the vacant office. That letter was, it is stated, written in error, without the sanction or knowledge of the president and council, but in view of it a special meeting was called to consider the matter, when the council decided to adhere to the decision at which they had already arrived in the ordinary and regular way—a decision which is obviously in the best interests of the Royal Society as a whole, and doubtless the great majority of the fellows will support it by their votes on Monday.

UNIVERSITY AND EDUCATIONAL NEWS.

General F. M. Drake, of Des Moines, has bequeathed $50,000 to Drake University.

The fund left by Mr. Lewis Elkin for annuities for women teachers of the public schools of Philadelphia, is said to amount to $1,800,000.

A donor who wishes to remain anonymous has given, through Professor Sterling, £50,000 to University College, London, to be used for the promotion of higher scientific education and research.

Ottawa University, a Roman Catholic institution, was destroyed by fire on December 2. The loss is said to be at least $200,000, most of which is covered by insurance. Three of the priests were seriously injured. The main building of Jewell Lutheran College in Iowa has also been destroyed by fire. The loss is estimated at $25,000, one half being covered by insurance. One of the students was killed.

The Rev. George Morgan Ward has been elected president of Wells College, Aurora, N. Y.

Dr. C. H. Judd has been made acting director of the Yale Psychological Laboratory for the present year. At the same time an advisory committee on the laboratory has been appointed consisting of Professors Ladd, Duncan and Sneath.

Dr. James E. Lough, professor of psychology of the School of Pedagogy of New York University, has been appointed director of the summer school.

Dr. Horace Clark Richards, instructor in physics in the University of Pennsylvania, has been made assistant professor of physics.

At a meeting of the electors to the Wilde readership in mental philosophy, held on November 19, at Oxford, Mr. William McDougall, M.A., M.B., fellow of St. John's College, Cambridge, and reader in experimental psychology at University College, London, was elected reader in place of Mr. Stout, recently elected professor of logic and metaphysics in the University of St. Andrews. Mr. McDougall took the degree of B.Sc. with first-class honors in geology at Victoria University; he afterwards gained first-class honors in physiology and anatomy in both parts of the Natural Science Tripos at Cambridge.

Mr. Reinhold F. A. Hoernlé, B.A., Balliol College, has been elected to the John Locke scholarship in mental philosophy.

Mr. W. M. Fletcher, of Trinity College, Cambridge, has been appointed demonstrator of physiology.